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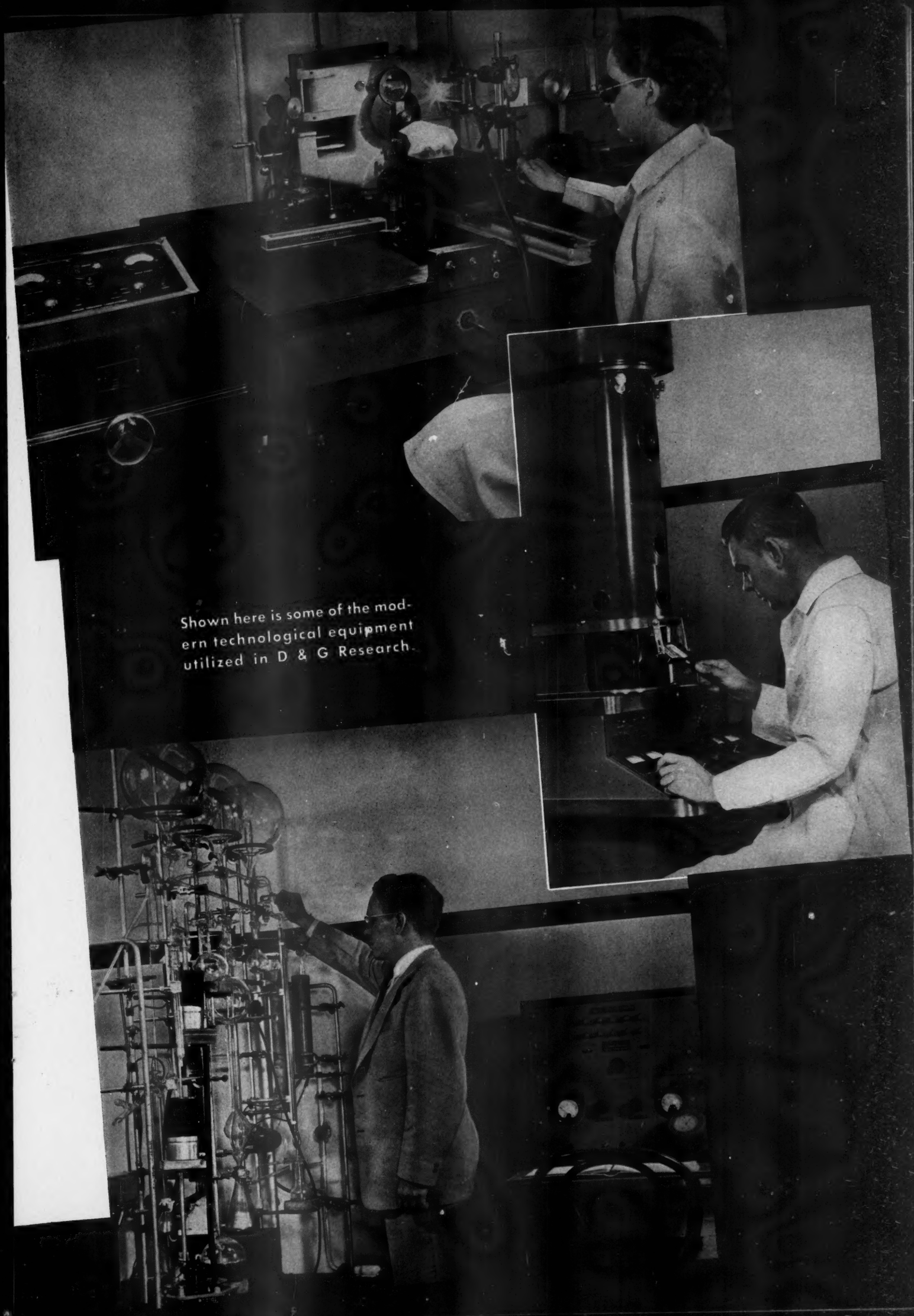

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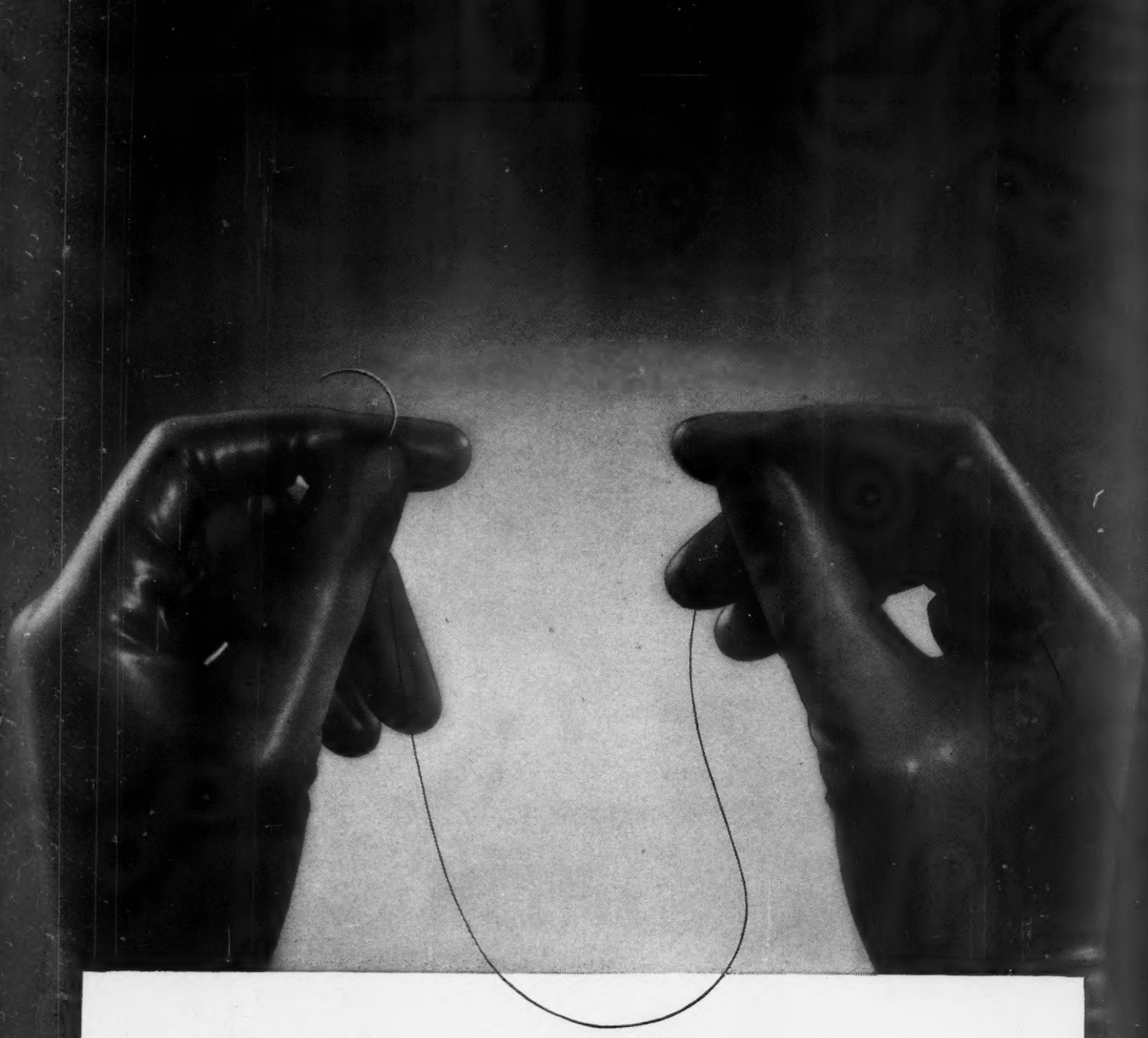

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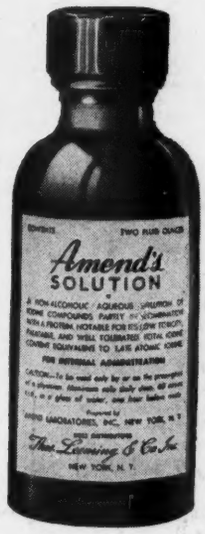

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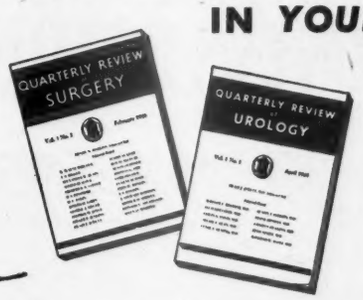

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4. Thorek, M.: Surgical Errors and Safeguards. Philadelphia, J. B. Lippincott Co., 1943, p. 64.

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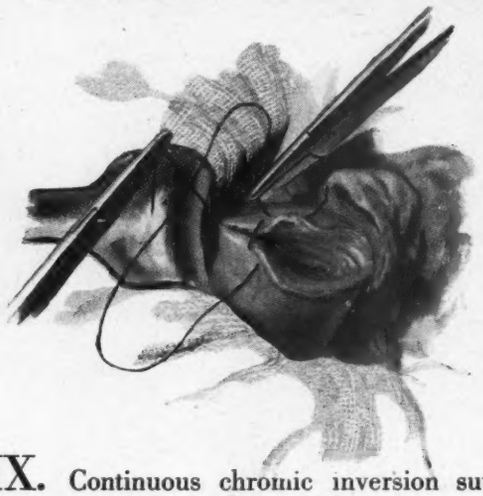
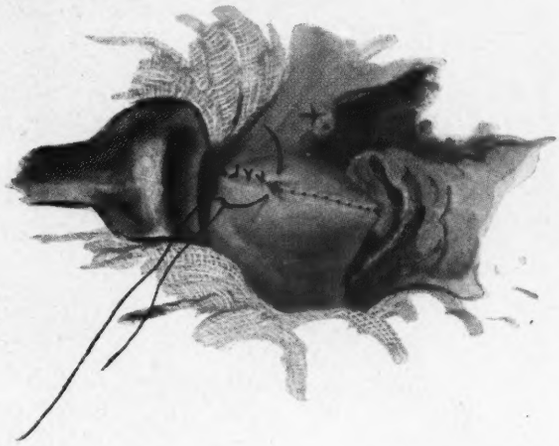
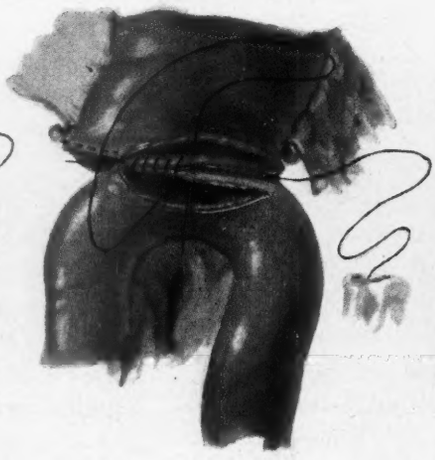


IX. Continuous chromic inversion suture being placed to close duodenum (Non-traumatic needle).

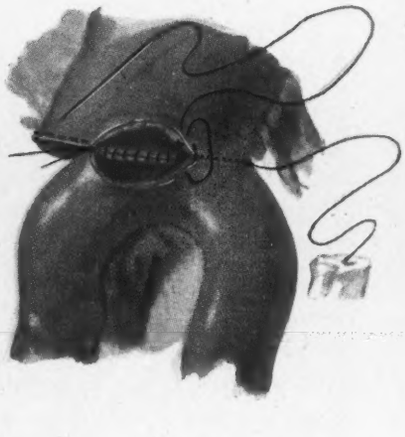


X. Outer layer of interrupted silk Lembert sutures.

XIII. Stomach opened by cutting away clip line to size of stoma. Jejunum incised to correspond.

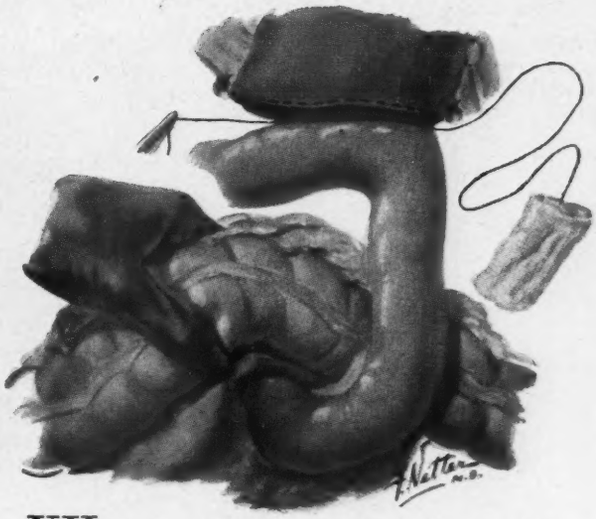


XIV. Posterior through and through continuous suture applied. (Chromic catgut—Non-traumatic needle).

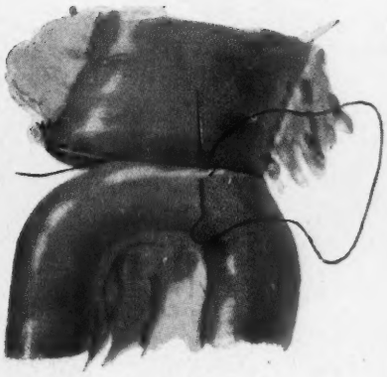


XV. Anterior inverting Connell suture being placed.

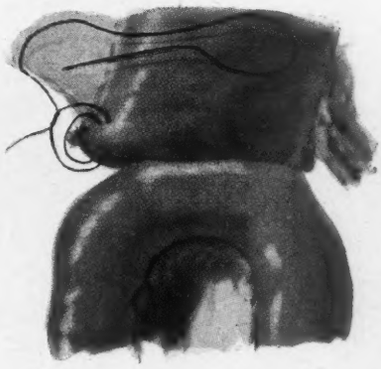
XI. Duodenal stump apposed to pancreas by plain catgut sutures.



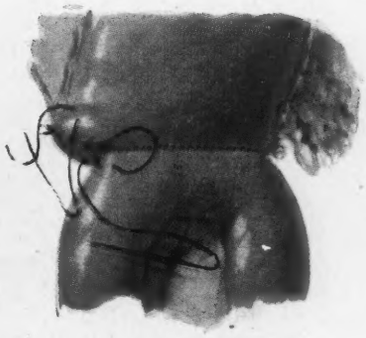
XII. Jejunal loop picked up about 8" from duodeno-jejunal angle; brought in front of colon, for gastroenterostomy; posterior serous suture placed (fine silk).



XVI. Anterior seromuscular suture being placed.



XVII. Inversion of upper angle of stomach including stump of left gastric artery.



XVIII. Coronal suture placed. Additional suture will appose pendulous jejunal loop to stomach when tied.

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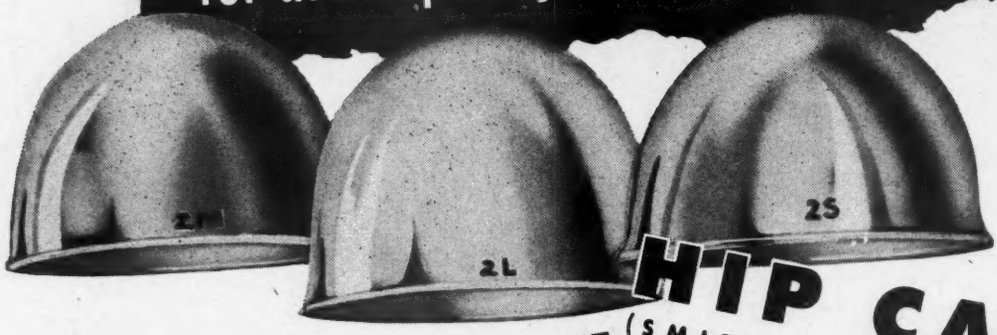

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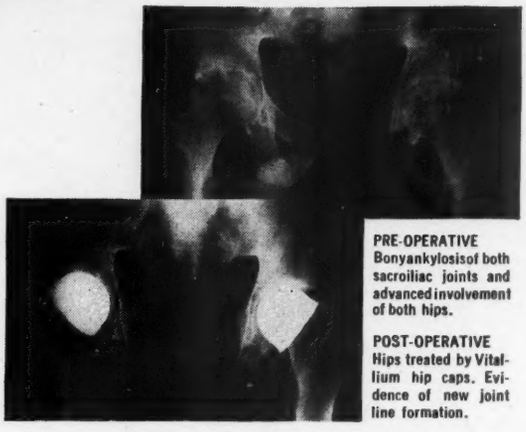

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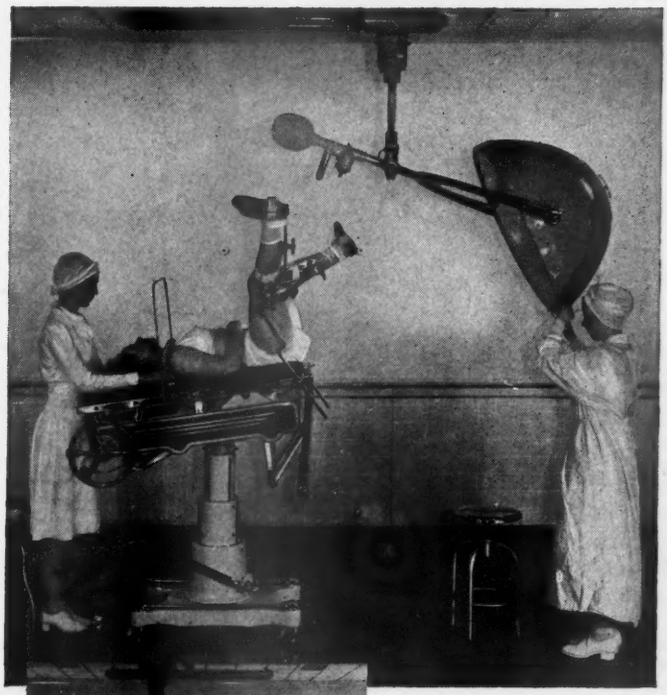

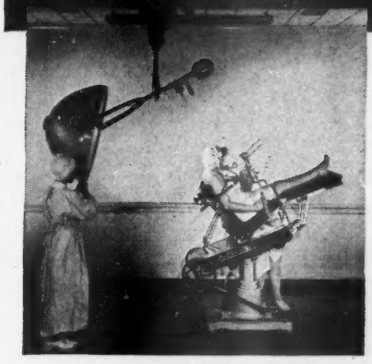

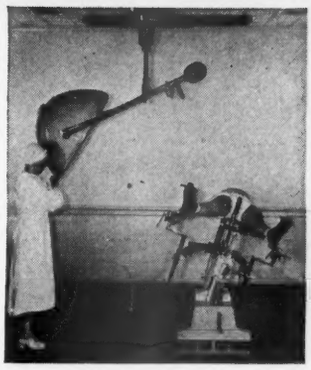

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REFERENCES

War Dep't. Technical Bulletin—March, 1945 TB Med. 151

Sumner L. Koch, M.D. "The Use of Compression as a Surgical Principle in the Treatment of Injuries." Quarterly Bulletin—Northwestern U. Medical School—1943, Winter Quarter,

Faxon—N. W. and Churchill. F. D. The Cocoanut Grove disaster in Boston. A preliminary account, J.A.M.A. 1942, 120: 1385

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*Olson, C. T.: "The Place of Tantalum in Surgery," Industrial Medicine, 13: 917, November, 1944.

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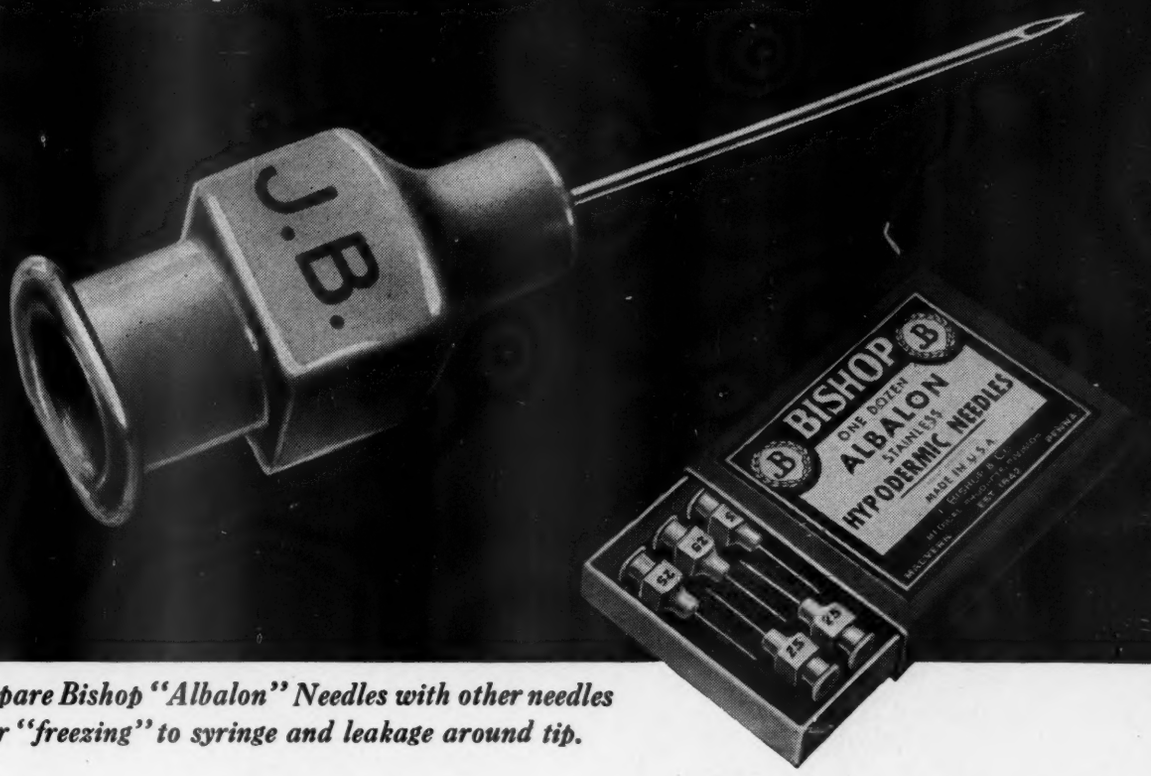

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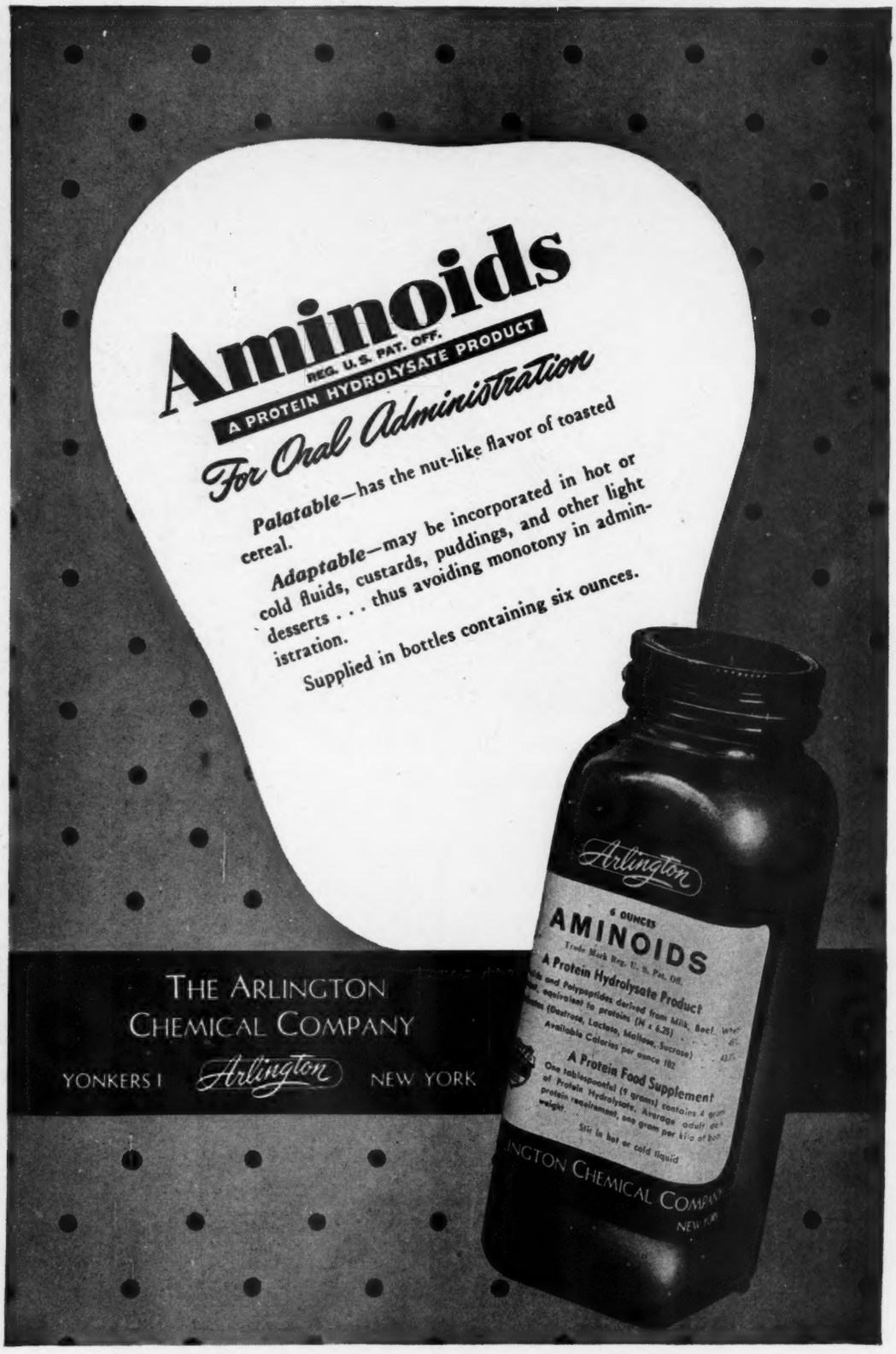
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(Goldman and Markham: Jl. Clin. Endocrin., 2: 237, 1942.)

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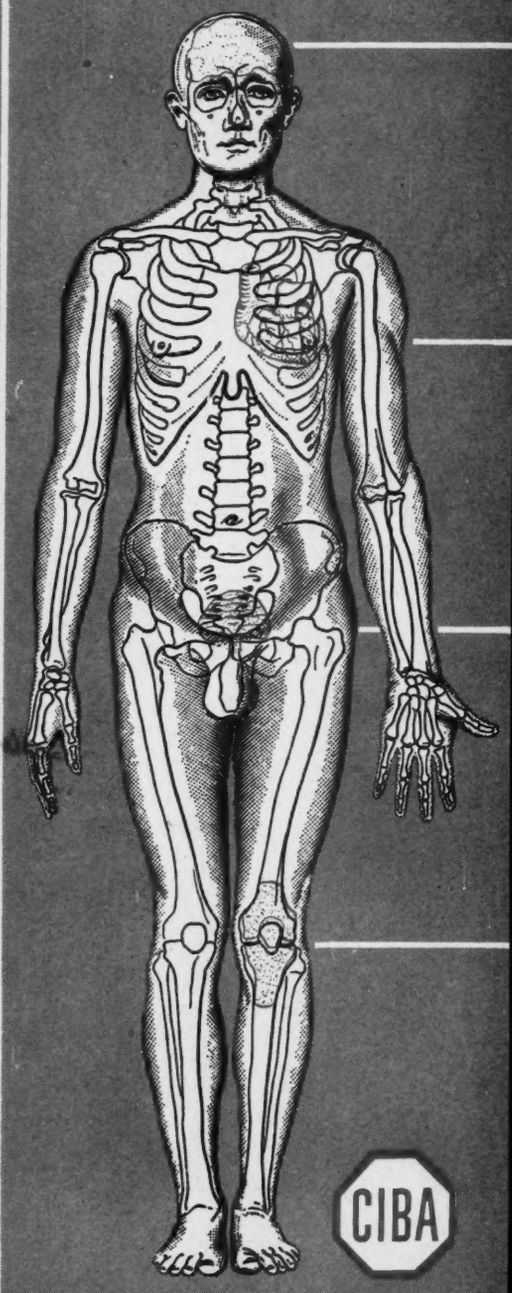

PSYCHIC—Symptoms of the climacterium in the male may include general mental depression and inertia, nervousness, irritability and irascibility. Inability to concentrate and impaired memory are accompanied by a feeling of uncertainty.[2,3]

CARDIAC—Attacks of angina-like pain which are not necessarily related to effort or to the time of night or day, and which are not relieved by nitroglycerine, are a clinical feature by which the cardiac syndrome in the male climacterium may be recognized.[2]

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REFERENCES: 1. Goldman, S. F., and Markham, J. J.: Jl. Clin. Endocrin., 2: 237, 1942. – 2. McGavack, T. H.: Jl. Clin. Endocrin., 3: 71, 1943. – 3. Douglas, R. J.: Jl. of Urol., 45: 404, 1941. – 4. Heller, C. G., and Myers, G. B.: Jl. Clin. Inv., 21: 622, 1942. – 5. Werner, A. A.: Urol., 49: 872, 1943. – 6. Lisser, H., and Curtis, L. E.: Jl. Clin. Endocrin., 3: 389, 1943.

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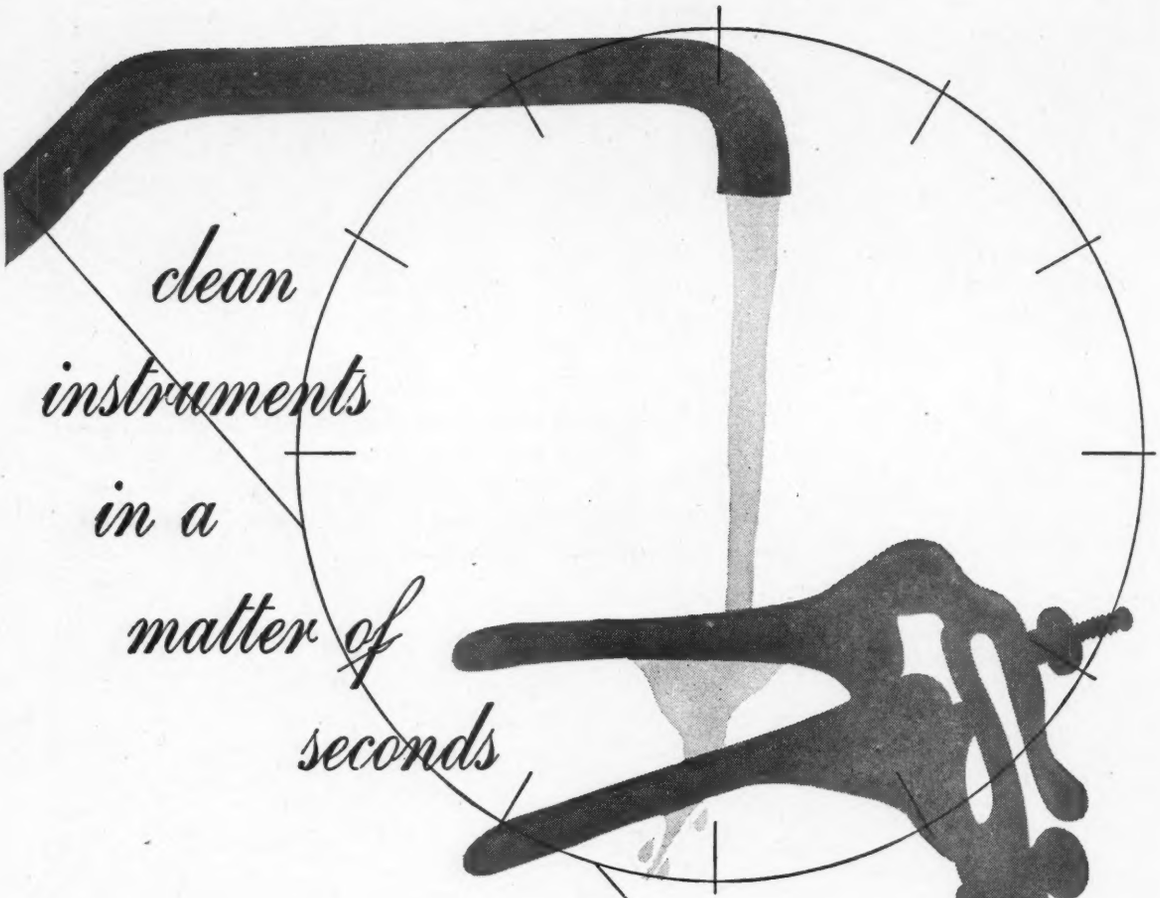

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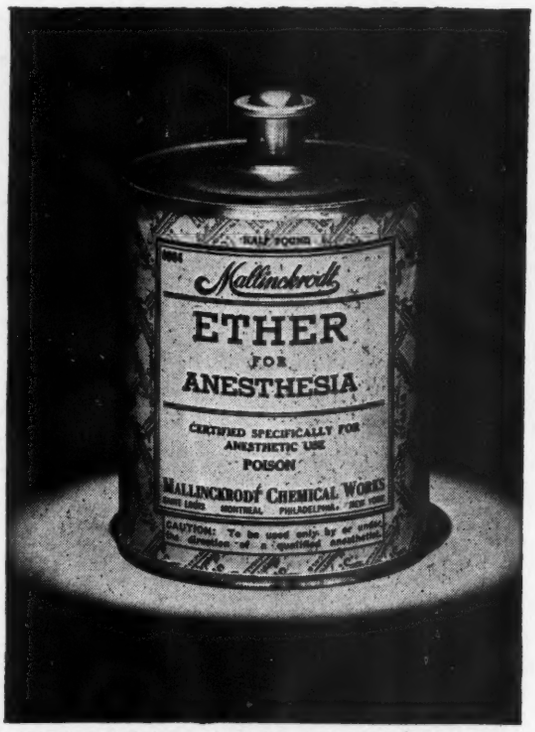

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*Stare, Frederick J., and Thorn, George W.: Protein Nutrition in Problems of Medical Interest, J.A.M.A. *127*:1120 (April 28) 1945.

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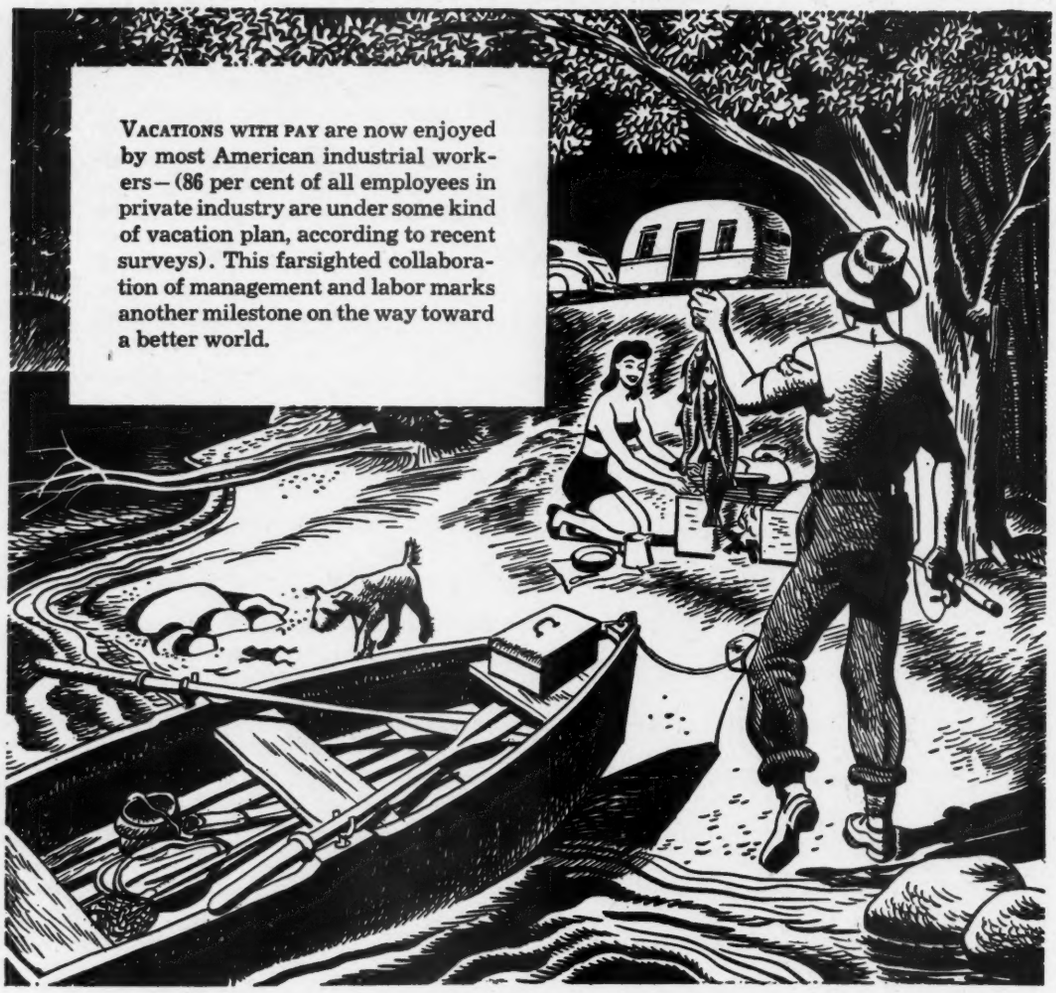

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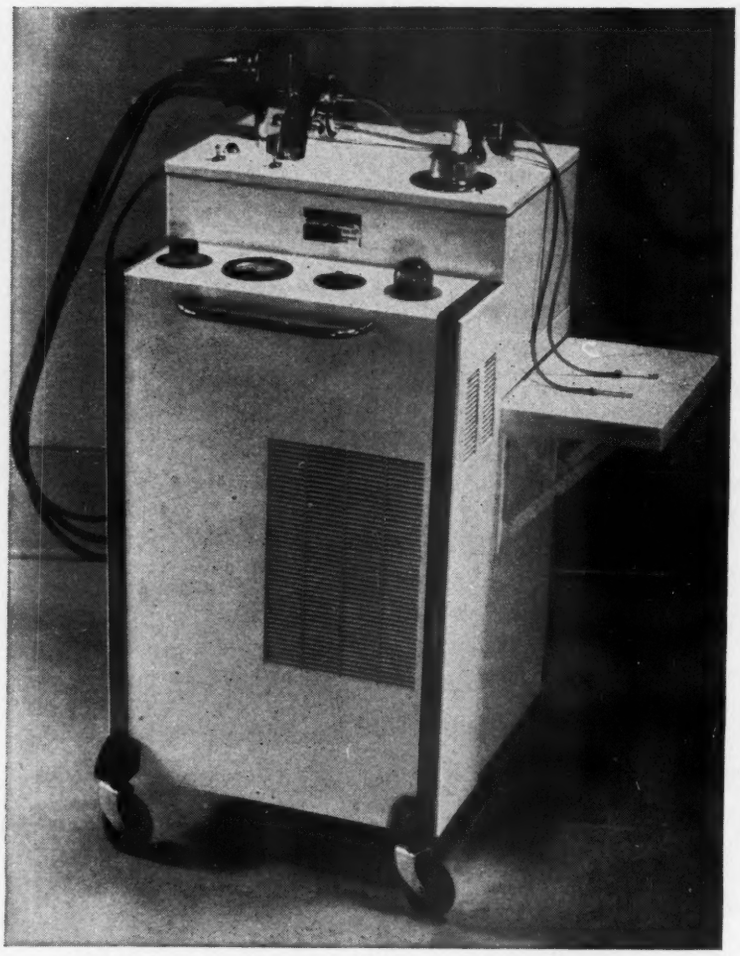

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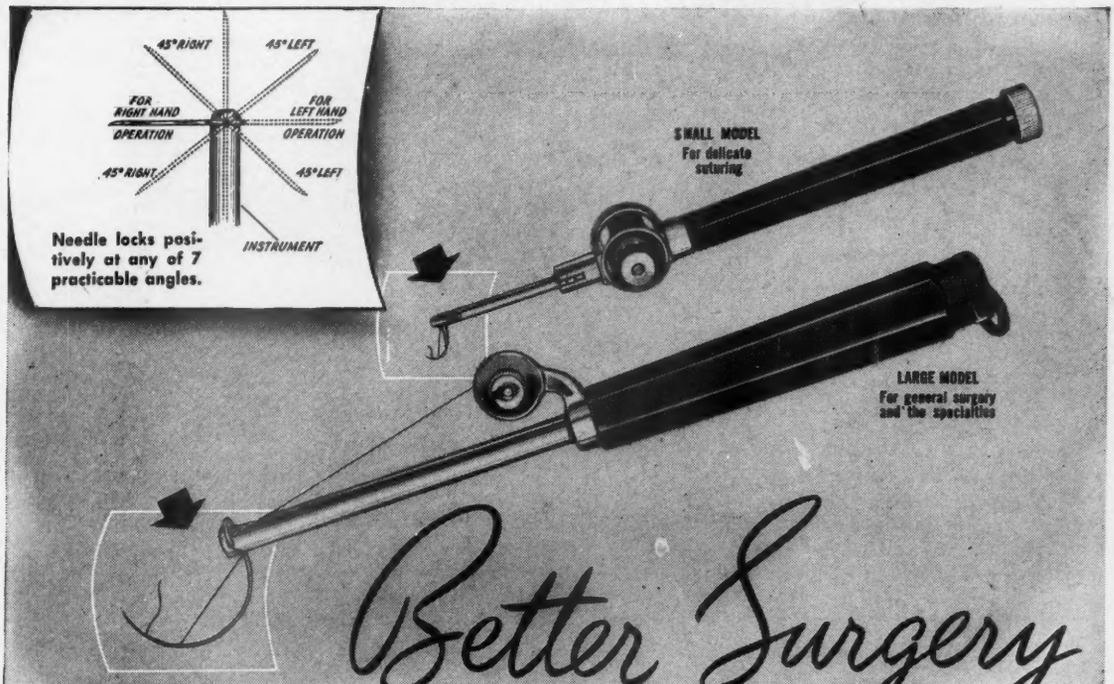

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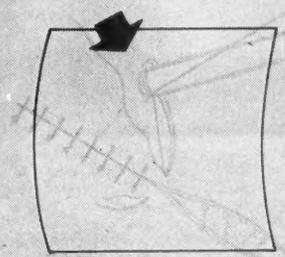

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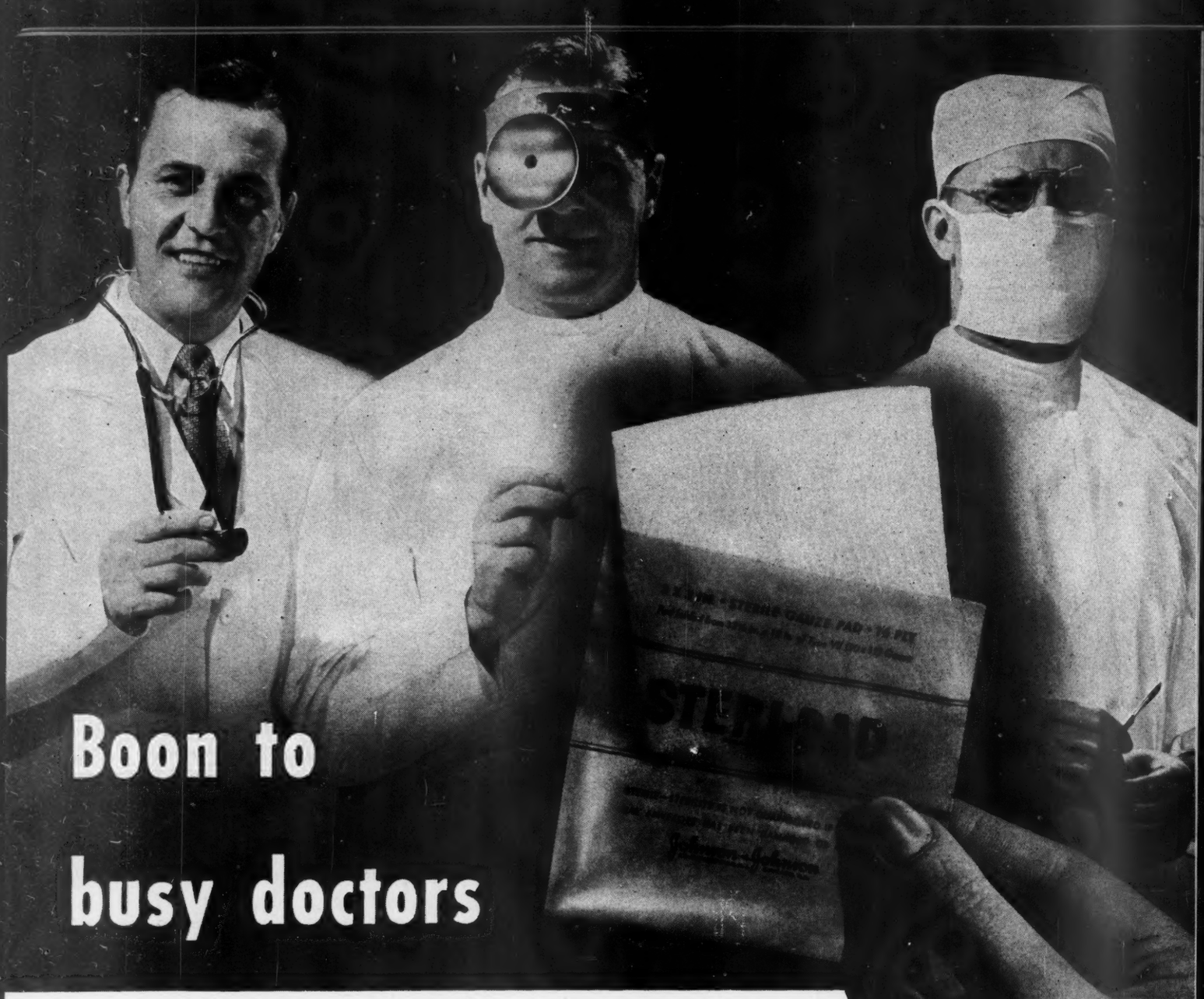

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VOL. LXXII AUGUST, 1946 NUMBER TWO

Editorial

A LETTER—EARLY POSTOPERATIVE AMBULATION

THE editorial by Dr. Roy D. McClure in the October, 1945, number of the *American Journal of Surgery* is right down my alley. His critical judgment of Hilton's conception ("physiological rest"), his correct interpretation of "The Fixed Period" (Osler's unfortunately misquoted and misunderstood lecture), and his penetrating analysis of Leithauser's more recent experiences are timely and suggestive.

More than twenty-five years ago I began, in a more or less conservative fashion, to allow my patients to move about freely in bed after operation, to encourage them to use their limbs and to sit up and get out of bed earlier than was then the custom. We observed no immediate ill effects or after results. When I started practice, it was the rule to keep all patients who had been operated upon for hernia in bed for four weeks. We reduced the time to three, then to two weeks and finally to ten days. At first I was skeptical and unwilling to go too far; for I had noticed that here and elsewhere some surgeons were using the early-rising and early-home idea merely to draw attention to themselves.

It was not until 1922, when a surgical service was established at the North Carolina State Hospital for the Insane, that I became convinced of the relative harmlessness of permitting patients, even following capital operations, to get up and around in the early postoperative hours. More through necessity than from choice these mental patients were permitted to do as they pleased. We had forbidden bodily restraint of any kind; in a few cases canvas sleeves, covering the hands, were employed to prevent tearing off of dressings, and defilement of incisions.

It was not very long before things began to happen. Once at midnight a nurse called on the telephone to report that Mrs. X, who had had an interposition operation for uterine prolapse performed that afternoon, had got out of bed, been to the bathroom and was then walking up and down the corridor. My answer was, "let her alone." What happened? In a little while she went back to bed of her own accord; and during the two weeks' "convalescence" she was up when she liked and in bed as she willed. The final result, both symptomatic and technical, was the best we had ever attained in that type of operation. There was no instant disturbance of the sutures and healing proceeded satisfactorily. The patient remained in the institution for a long period and was examined as late as five years after operation, definitely cured of her prolapse. Thirty-odd other patients were subjected to the same procedure, submitted to the same postoperative régime and came through with no untoward effects.

It might be presumed—and naturally so—that the interposition operation would

represent the severest test and the most uninviting procedure for early postoperative mobilization. Our hind-sight conception was that the absence of complications might be owing to the fact that in the upright position the abdominal pressure fell upon the posterior aspect of the uterus, keeping it forward, thus obtaining the desired objective; whereas, with the patient flat on her back, the pressure would tend to bear upon the anterior surface of the uterus. To be considered also is the freedom from catheterization in patients who were allowed bathroom privileges.

In all other operative patients at the State Hospital, extending over a period of seventeen years, including operations on the gallbladder, stomach, intestines, chest, perineum, for hernia and hemorrhoids, etc., the same lack of restraint and voluntary behavior was granted. In no instance was there any imperfect result which could be attributed to early ambulation.

In respect to early mobilization there is a marked difference in behavior between insane patients in an institution and apparently sane patients in a general hospital. It would be difficult, indeed, to persuade or successfully to order all our patients to get out of bed on the day of operation or even during the first few days. To them it would be painful, frightening, out of the question. In many instances it is impossible to induce them to move about in bed, much less to stand on their feet or sit in a wheel chair during the first week after operation.

With the insane, however, it is comparatively easy; and in many cases needful, to satisfy their restless desires to roam about, to follow their inclination, unheeding, as they are, of pain and fear. The mentally diseased person is already conditioned, has had his recoil from society and is living in a world of his own; the normal patient in our ordinary cosmos still has his psychic fears and reacts accordingly. It would be surprising to the uninitiated to observe how readily the psychopathic institutional patient approaches a surgical operation and how seldom any violent reaction occurs.

My years of experience in the surgical service at the State Hospital encouraged me to proceed further with early mobilization and ambulation. Up to my retirement in 1938 I continued to urge all my patients in general hospitals to adopt it whenever I possibly could. Many of them positively would not even attempt to get out of bed and stand upright on the day of operation. I wish I could have been half so successful in the trick as Leithauser seems to have been.

Certainly we have all heretofore routinely kept most of our patients in bed too long. Comes now the opportunity to test time against performance, to gain experience at the expense of expediency. Without doubt the proposal, in Dr. McClure's words, "merits further consideration and trial," guided, I may add, by selective judgment. We might after all be able to prevent some of the calamities previously considered providential.

HUBERT A. ROYSTER, M.D.

Original Articles

CONSERVATIVE GYNECOLOGY

ARTHUR E. HERTZLER, M.D.
HALSTEAD, KANSAS

CONSERVATIVE gynecology seeks to conserve the woman. Really it might be better to call it preservative gynecology. Her essential apparatus centers in the endocrine system. True enough the ovaries are not the only stars in the endocrine constellation, but they are the only ones accessible to amateur operators.

When I was in Berlin I attended Professor Olshausen's clinic. He was the first man in any country to have removed a hundred pairs of ovaries. But in my day he was the most conservative man I have ever known. He knew what he was talking about. He was human and a man of courage and saw the sufferings castrated women undergo. He wrote a monograph on the subject which I still possess. "Never, no never, remove all of both ovaries" he vehemently proclaimed. I can still hear the agony of his tones as he proclaimed: "I have seen enough."

The daily experience in my clinic is really shocking. Young women with their pelves "cleaned out," even unmarried girls under twenty. As many as five such patients come to the clinic in a single day.

Leaving Berlin, I later had the chance in my position as hospital pathologist to section hundreds of ovaries removed by regular surgeons for what they called dysmenorrhea due to cystic disease. This was known as the Batty operation, not because it was that but because it was the name of the surgeon who first advocated this type of operation for anything the patient complained of. There were small cysts all right but they were like the ovaries I took with me to Berlin which Gebhard pronounced normal follicles.

The primary trouble is that few surgeons are pathologists. An exact knowledge of pathology is the primary requirement for any conservative operation. It is definitely a knowledge of pathology of the operating room. When the material removed comes to the pathologist, it is too late. Because of an ignorance of normal structure, developing follicles are regarded as pathologic. Few realize how small a piece of ovarian tissue is required to preserve the menstrual function. Olshausen's statement that a piece of ovarian tissue the size of a grain of corn will keep up the menstrual function still holds good. The surgeon must know, tissue in hand, where this necessary bit of ovarian tissue is located in order to preserve it.

Few teachers of pelvic surgery, it seems, realize that to maintain the integrity of the ovary, enough of the endometrium must be preserved to insure the continuation of menstruation. These teachers turn loose a hundred graduates each year who do not know the end results of destroying the menstrual function. If these teachers knew the end result as the general practitioners, and the husbands, see them, the students at least might be different. If endometrial tissue must be preserved in order to insure the integrity of the ovaries, it naturally followed that the entire uterus must not be removed even for tumors of any size during the period of menstrual activity of the patient.

All that is needed to do a conservative operation is to know that it can be done

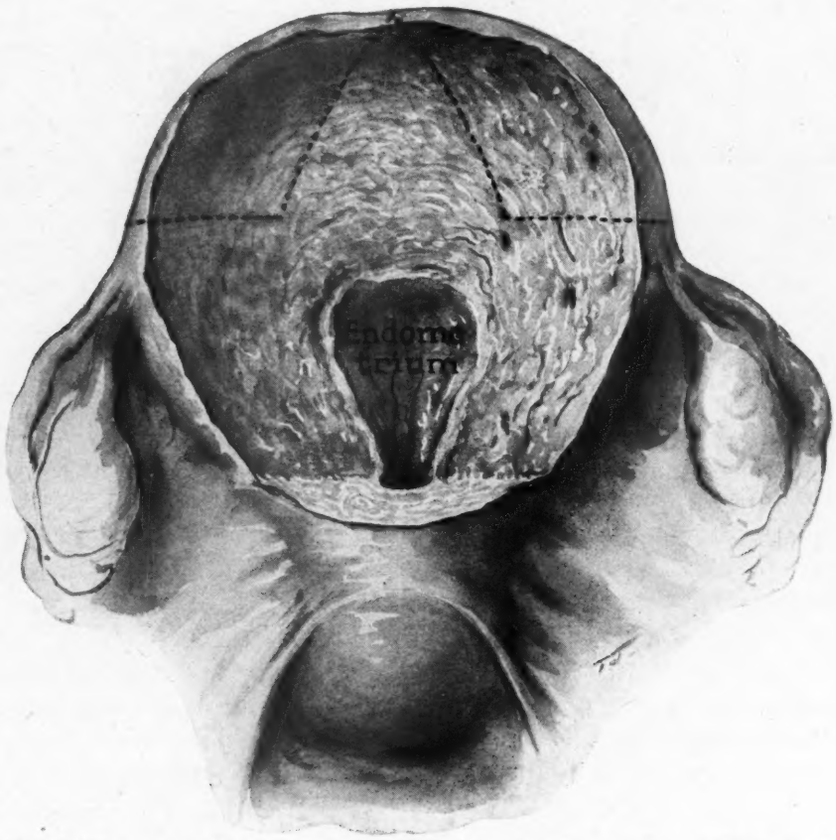

FIG. 1. The tumor has been removed and the redundant uterine wall trimmed off leaving an area of mucosa.

and the will to do it, backed of course by a knowledge of pathology.

I was possessed of this knowledge when my first patient presented a concrete problem. As I stood beside the operating table holding in my hands a uniform myoma the size of a fetal head, and hemorrhagic, the shades of Olshausen whispered in my ear that inasmuch as I did not wish to destroy this patient's nervous equilibrium I must preserve the ovaries and a part of the endometrium. The problem was just as simple as that, because I knew my gross pathology. I exposed the endometrium and circumscribed an area of endometrium about 2 cm. in diameter. (Fig. 1.) I then removed the tumor and trimmed off the enclosing uterine wall until I could fold it over the preserved endometrium. The flaps were sutured in place. (Fig. 2.) Today, I would cover the suture lines with the round ligaments. (Fig. 6.) The patient was an exceptionally brilliant young woman who later gained national eminence in women's work. Had I done a hysterectomy I would have preserved only a neurotic woman, lost to all usefulness.

My present technic is a build-up requiring more than forty years to accomplish. I shall refer briefly to some of my early steps. It will be well to present a schematic figure in order to make the various steps easier to comprehend. (Fig. 3.) A shows the lesion which may be a tumor or a hyperplastic endometrium The pathologic lesion, B, shows the reconstructed fundus; C, the completed operation with the round ligament covering the defect.

The first step in conservative operation is to know exactly with what one has to deal. When I do not know what caused a bleeding, I look to see. That is not exactly right; I do not look, but feel. If one's finger cannot tell hyperplasia of the

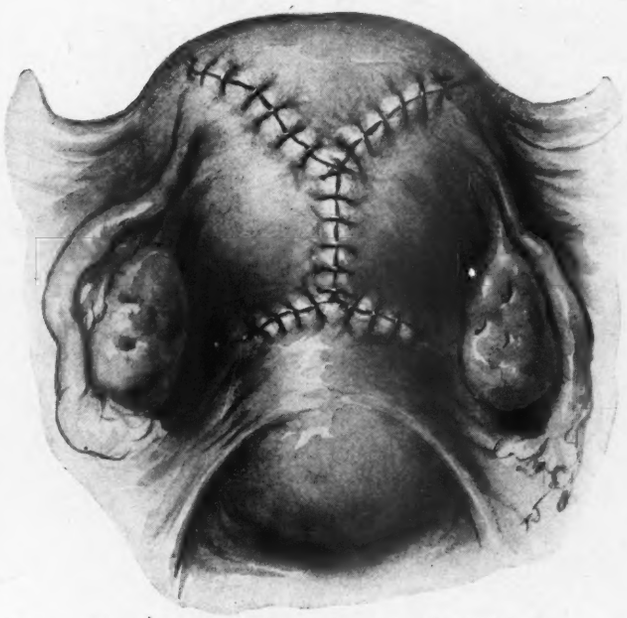

Fig. 2. The wall of the uterus has been folded in to cover the mucosa.

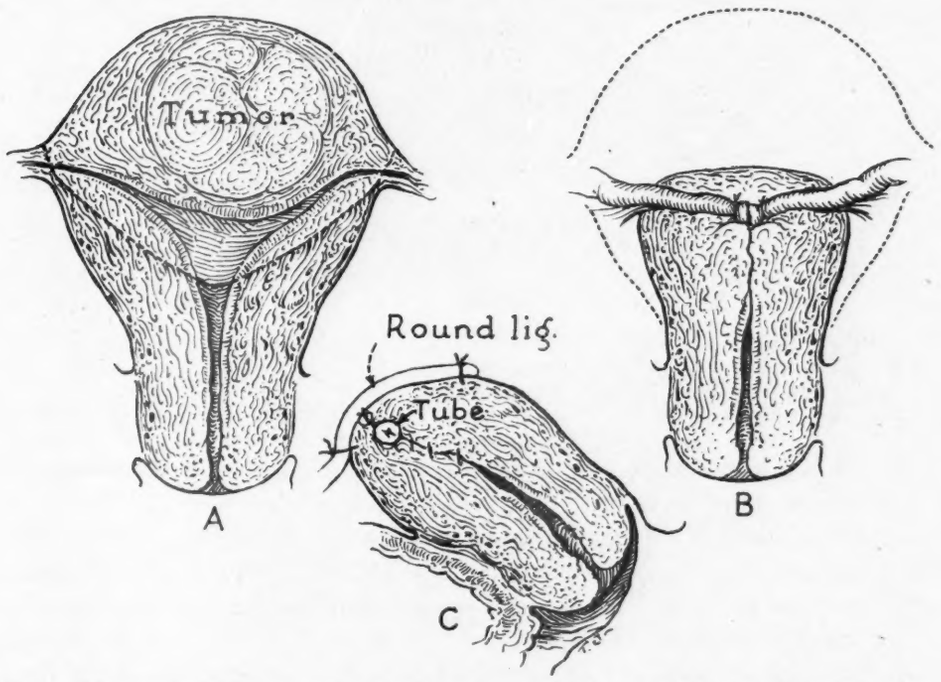

Fig. 3. Diagrammatic presentation showing the underlying principles of all conservative operations: A, the pathologic lesion has been removed; B, the uterine wall is closed after the ends of the tubes and broad ligaments have been pulled in; C, the round ligaments cover the suture line of the incision.

endometrium from carcinoma, he needs more training in gross pathology. I heard Olshausen say nearly fifty years ago that it could be done, and I believed it could be learned.

With Figure 3 in mind the details of technic become clear. Figure 4A shows the pathologic lesion in process of removal. One explores the entire endometrium, including the cervical canal. The extent of the pathologic lesions being determined and removed, the closure of the wound is

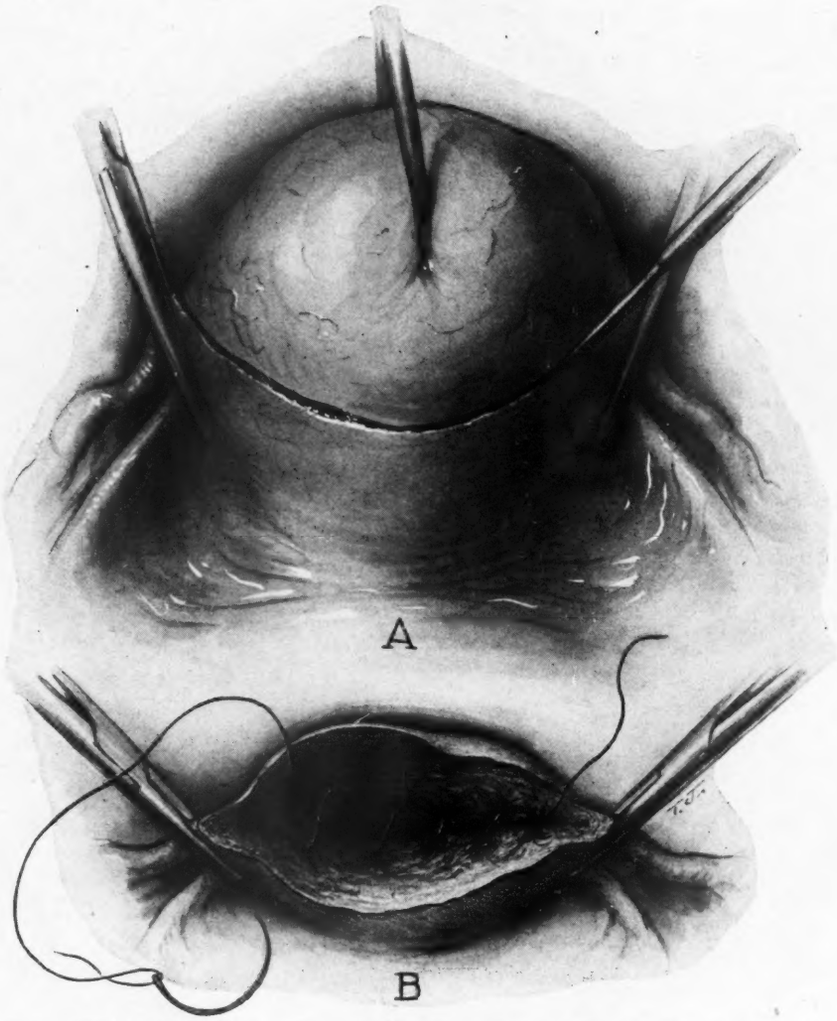

Fig. 4. The technic is shown more in detail: A, the pathologic lesion is removed; B, the first line of sutures beginning the coaptation of the cut uterine wall is placed just above the preserved endometrium.

in order. (Fig. 4B.) The first line of sutures is placed just above the preserved endometrium. Figure 5C shows the remaining uterine wall coaptated in order to control bleeding. The ends of the tubes and round ligaments are drawn together. (Fig. 5D.) In Figure 5E the uterine wall is coaptated.

The most important step in the operation cannot be shown in a picture. The uterine flaps must fall together. If a pull on the suture is needed to bring the flaps together, they will tear out. This may be obviated by covering the suture line in the wall of the uterus with round ligament and the adjacent peritoneum. (Fig. 6.) By judicious application of these sutures the uterus is held in its normal position even though it was retroflexed before the operation.

As a bit of facetiousness, I have been in the habit of telling my students that the first ten thousand thyroidectomies are the most difficult. A more cheerful remark can be offered here. After the first thousand operations, all the points mentioned above become automatic.

A number of pitfalls must be pointed out. Some operators not satisfied with a hysterectomy, do a panhysterectomy. The handle of the pan is of course the cervix and the skillet is the rest of the tumor. The argument for this operation is that the cervix if allowed to remain may develop cancer. That is a delusion. I

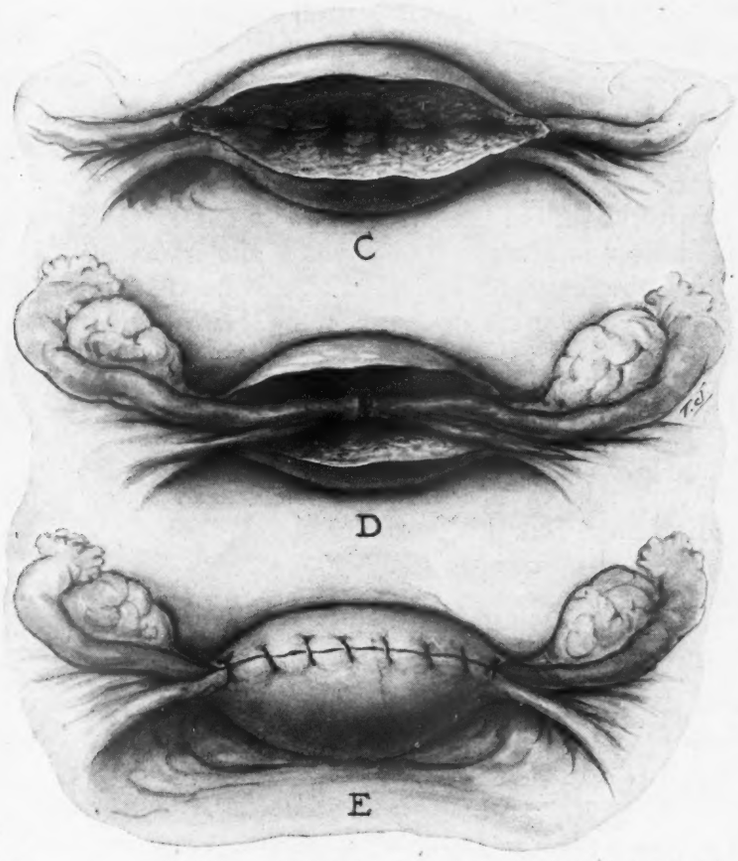

Fig. 5. C, coaptation completed. As many lines are placed as needed to control the hemorrhage. D, the tubes and round ligaments are drawn together. E, the edges of the uterine wall cover the ends of the tubes and round ligaments.

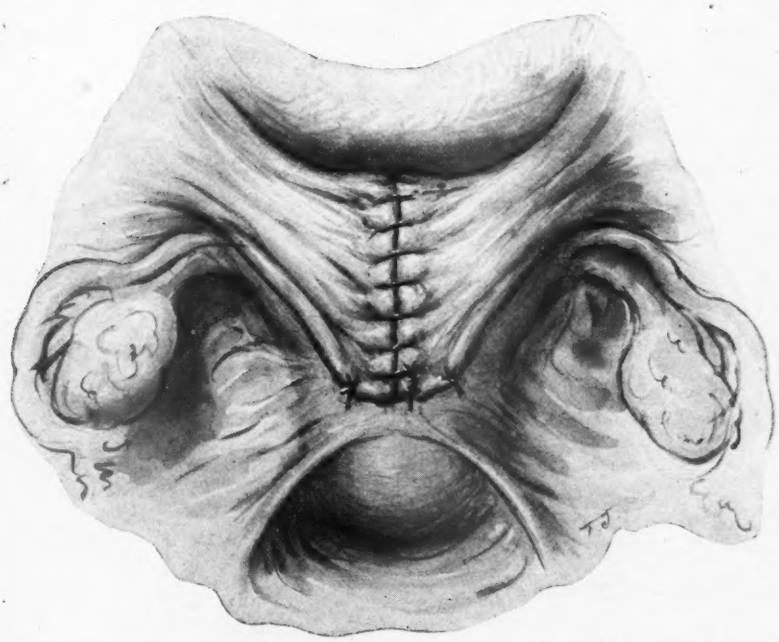

Fig. 6. The suture line in the uterus is covered by the round and broad ligaments. This secures the suture line and also prevents the formation of endometrial fistula.

have seen but one cancer of the cervix after a hysterectomy in all my experience. I saw this patient three months after the supracervical hysterectomy for myomas. She had a well developed cancer of the cervix. The previous operator was one who cut first and looked afterward, only in this case he did not look before or after.

The point is that the cervical canal should be explored before the lesion of the uterus is attacked. If this is not done before the abdominal incision is made, one can when the lesion is exposed explore the cervical canal with a curet.

The panhysterectomy advocates admit that the vagina is shortened. But this does not bother the operator. But when Papa asks the family doctor, it is different.

Just to indulge in a bit of air conditioning I shall indulge in a parting kick. It is generally recognized that it is the unloaded gun that causes the fatal shooting. Radium is the unloaded gun to the owner of the radium. Too often now when there is bleeding from the uterus a piece of radium is inserted and the operator waits to see what happens. Too often plenty happens. Its chief advantage is that it requires not the remotest knowledge about pathology, beyond the recognition of escaping blood and this can be determined by hear-say evidence. Radium most assuredly has its place but only for the cure of diseases in which the nature of the lesion is known and can be written on the chart where it can be shown the attorney for the plaintiff. The use of radium involves something more than just the forearm muscles to push it in. The use of radium, and *x*-rays as well requires as wide knowledge and experience as does a pelvic operation.

CONCLUSIONS

The purpose of this paper is to call attention again to the havoc wrought on the women by destroying their menstrual function, and to indicate in a brief way the technic to be followed in doing the conservative operation.

The old adage holds here: Where there is a will, there is a way. The will comes when the problem is understood.

BOILED CARTILAGE IMPLANTS*

CHARLES FIRESTONE, M.D.

SEATTLE, WASHINGTON

THE history of tissue transplantation in general, and cartilage implantation in particular is not deemed contributory to this discussion. It is sufficient to state that cartilage has emerged as the optimum material for use as supportive tissue in improving congenitally bad cosmetic facial contour, and in rebuilding facial and cranial contour rendered poor by external trauma and/or by suppurative processes.

For a long period following the emergence of cartilage as the corpus electum for the purposes above stated, the source of the cartilage was almost wholly confined to the patient who was to be the recipient of the implant. This procedure still has its adherents among some plastic as well as cosmetic surgeons. Maliniac[1] as recently as August, 1945, advocates transposition of the upper lateral nasal cartilages to fill defects in the middle third of the dorsum nasi. It is interesting and somewhat ironical that in the very issue of the "Archives" that contains Maliniac's manuscript, Griesman[2] points out that these very cartilages transposed by Maliniac are necessary for the nasal pyramid to resist narrowing of the nasal cavity.

This procedure came to be known as the iso implant, and yielded suitable cartilage. It was timely in each instance, since the cartilage was obtained at the operation at which it was needed, and its structure and consistency was adequate, since most patients who sought cosmetic corrections were subjects of ages possessing cartilage that was of sufficient hyalin content, had adequate tensile strength and was generally shapeable to meet the exigency of the particular case. Preservation problems just did not exist, since each patient ipso facto was an excellent material source for his own needs.

Disadvantages, however, were legion. Each cosmetic surgical operation requiring cartilage implantation of necessity had to be fathered by a prior operative procedure, which was definitely a non-cosmetic one; i.e., the surgery incidental to obtaining the cartilage. Since the cartilage was generally obtained from the thoracic cage, it produced debility and morbidity out of all proportion to the morbidity produced by the actual cosmetic correction. In one of the author's cases, the patient developed a circumscribed pulmonary congestion, with pleuritic pain and fever, and was diagnosed by the internist as suffering from induced pneumonia. In some instances this twin procedure also constituted a deterrent for the individual seeking cosmetic correction.

Time, however, had wrought changes that impelled cosmetic surgeons to seek and find other sources than the patient himself. The morbidity of the parent operation and its deterring influences on the patient, were not alone the causes that impelled the cosmetic surgeon to seek other sources. The dynamics of time and the mutations of modes also acted as compelling stimulants for the search. Patients no longer parenthetically in the younger generation, appeared on the scene desiring cosmetic corrections. Adults whose ages had wrought physiological changes in their own cartilage, changes which had rendered it inadequate for implants, were impelled by economic strivings, and some by their egos, to seek belated corrections of their aging facial contours. Thus the

* Presented at the annual meeting of the American Otorhinologic Society for the Advancement of Plastic and Reconstructive Surgery at the New York Academy of Medicine, November 15, 1945.

FIG. 1. Patient with depression of lower third of nasal pyramid, resulting from a blow sustained in a boxing match. Surgical attempt at cosmetic correction three years previously ended in failure. Correction was effected by implantation of boiled homocartilage from two separate ethnic sources. A strut of cartilage from a melanderm subject was employed for the elevation of the nasal tip. A strip of cartilage from a leucoderm subject was implanted over the dorsum. Both implantations were accomplished at the same operative session.

FIG. 2. Appearance of patient three months subsequent to implantations. No difference in intensity of reactions was discernible at the sites of implantation.

homo-implant came into being and today is generally employed by cosmetic surgeons as the cartilage implant of choice.

SIGNIFICANCE OF SOURCES

With the emergence and the adoption of the use of the homo-cartilage implant, there arose the problem of preservation of the cartilage after it was obtained from its suitable source. Suitable source is not here referred to categorically, since not all are agreed on the suitability of the source. Straith and Slaughter[3] advocate the use of middle-aged cartilage, for the reason, they state, that such cartilage does not contain too much fibrous tissue, nor has it undergone too much calcification. Many others, including this author, have found middle-aged cartilage too brittle, and have been inclined to employ the cartilage from subjects thirty-five to forty years of age, after having planed way the outer or fibrous portion. Suitability is thus somewhat of a moot question.

Straith and Slaughter[3] also adduce the collective observations of Born,[4] Rand and Browne[5] and Ullman,[6] together with others, Quoting them, "That, in general, transplantability increases with the ontogenetic and phylogenetic primitiveness of the organisms which serve as hosts and donors, . . . and emerge with the following dictum of their own: . . . The further removed the relationship of individuals, the fewer chemical characteristics the individuals have in common, and in attempting transplantation of tissues between individuals, the presence of these unlike chemical characteristics in donor and host is the basis for reaction."

This author has repeatedly utilized cartilage from a Japanese subject, and from a colored subject, for transplantation into caucasion hosts. In two cases (to be

illustrated) he has implanted cartilage from twin sources as far apart as negro and caucasion, and Japanese and caucasion, into the same host, without obtaining any reaction differential. In one case (to be illustrated) heterogenous, (bovine) cartilage was implanted. This implant did produce an increased reaction, which can be utilized in some instances as ends in themselves. Caucasion cartilage was in one case implanted into a Chinese recipient without any noticeable reaction differential.

It is not amiss to note at this juncture that the author's observations, resultants of experience as they are, while pointing divergences in suitabilities of cartilage sources, impart data of perhaps greater significance to the related science of anthropology. It rests, of course, with the anthropoligist to evaluate and correlate them into his particular scientific scheme. However, to a profession ministering to the ailings of a badly disordered world these observations bear with them corollaries of major significance. If transplantability of cartilage is a coefficient of likeness of chemical characteristics, (as argued by Straith and Slaughter and the authors they quote, and by others not quoted,) these observations would definitely indicate that ethnic differences as far as chemical characteristics are concerned, are purely mythical, or so infinitesimal as to be undiscernible, and would deal a mortal blow to the racists generally. These observations indicate that God has created mankind in one general chemical image, even if the biblical quotation of "God created man in His own image"[7] is not accepted by all. They also accentuate the principle of the venerated French philosopher Blaise Pascal (1623–62) as quoted by Huxley,[8] to the effect that "The whole succession of men through the ages should be considered as one man, ever living and always learning."

FIG. 3. Frontolateral view of patient with maldeveloped nasal pyramid.

PRESERVATION AND STERILIZATION

O'Connor[9] adopted the use of 1 part of 1:1000 solution of merthiolate mixed with 4 parts of normal sterile saline as a preservative for the cartilage, storing it in this solution under refrigeration, culturing and changing the solution at relatively frequent intervals. Straith and Slaughter[3] practice the same procedure. The term employed by each of these authors to the preservative solution is "merthiosaline." O'Connor's dictum of the above preservation procedure has become relatively excathedra, as it has had wide acceptance and usage, at least in this country.

Lamont[10] states that cartilage is taken from patients "in exitus," fixed, and preserved in merthiosaline. The phrase "in exitus" employed by Lamont, besides strongly implying viability as desirable, produces a bewildering reaction even in the professional individual who may find himself in exitu. By way of comment, this author would insist, in his own particular case, that his own cartilage be removed *in statu post exitum.*

Straith and Slaughter[3] state: "Homografts, whether used as fresh or as preserved material, have about equal advantages as far as the question of immediate result at the site of implantation in the new host is concerned. Live homo-grafts

FIG. 4. Lateral view of same patient as in Figure 3 showing her average attitude of expression.

FIG. 5. Lateral view of same patient three months following reconstruction of dorsum by implantation of boiled cartilage from xanthoderm subject. The nasal tip remains relatively low for optimum cosmetic result.

are transplanted with the knowledge that they will probably become at least partially necrotic and eventually be invaded by connective tissue, even though it may be more or less viable." These authors continue; "The preserved cartilage . . . will not be viable but will act as a tolerated foreign body, and, because there is no active metabolism, it will not initiate such active tissue response on the part of the host." It is difficult to reconcile the authors' statements with their advocacy of the use of mild merthiosaline as preservative.

The procedure of the three authors successively referred to above is generally representative. The statements and technics of these authors emanate an aura of adherence to viability. In the application of these technics, these authors definitely practice in proximity-to-viability fashion. Thus, O'Connor tends to confirm the aura of viability by stating that in particular cases he injects merthiosaline into the graft bed. Inferentially this mild merthiosaline inhibits and destroys pathogenic organisms of live organic composition, without having the same effect on organic tissue in the graft bed. Straith and Slaughter state: "Too great a concentration of mercurial salts in the cartilage may result in a purely chemical irritation in the new host. An effort to maintain as nearly as possible a physiologic solution and yet maintain steriliyt is the method of choice." In brief, the last sentence admonishes the reader to adhere as close to viability as feasible. Yet these authors conclude that preserved cartilage is more suitable and, as implants, will be better tolerated by the recipient. Lamont remains even closer to viability by his removal of the cartilage from subjects "in exitus" as he states.

In the opinion of this author these procedures are not only non sequitur but assume an aspect of sheer sophistry when considered vis-a-vis the acceptance by all of these authors, that the foreign body implant is the optimum implant. If cosmetic surgery is a science as well as an art, the scientist in the cosmetic surgeon should, and, indeed must, act on his intelligence of scientific data, and on the conclusions he has reached. If sterile

Fig. 6. Lateral view of patient two months following second implantation. A boiled cartilage strut from a leucoderm subject was implanted via the sublabial route for the purpose of raising the nasal-tip after loosening the columellar base. No difference in tissue reaction was discernible. The slight elevation of the nasal tip afforded that subtle entity which yielded the desired cosmetic result.

Fig. 7. Front view of same patient two months following second implantation of boiled homocartilage.

preserved cartilage is deemed optimum for implantation purposes, do not the methods of the above authors stand out in bold relief as contradictory? What better means of obtaining this desired end is known to the medical profession than accepted adequate chemical preservatives, and/or the destruction of pathogenic organisms by the all accepted method of boiling?

AUTHOR'S METHOD OF PRESERVATION AND STERILIZATION

This author has adopted procedures giving practical effect to this reasoning. Cartilage obtained in the usual manner has been employed. Two of the sources were from subjects who had been embalmed and prepared for burial three days previous; one a xanthodermic (Japanese) subject, the second a melanodermic (negro) subject. The cartilage from a third leucodermic source was dispatched to the author's office in a 10 per cent formalin solution. In each instance the cartilage upon reaching the author's office was vigorously boiled for twenty minutes. It was found that the enucleation from the perichondrium was greatly facilitated. The cartilage was then placed in a 50 per cent solution of alcohol and kept therein at room temperature until the need for it arose. In one of the cases (to be illustrated) heterocartilage was employed.

When need for the implants arose, the vessels containing the cartilage were taken to the hospital. Pieces of desirable size were removed from the alcohol, washed in tap water, wrapped in gauze, and boiled vigorously for twenty minutes in the sterilizer, together with the instruments. The boiling removed all trace of the preservative. They were then brought to the operating room by the attendant nurse, shaped to fill the particular contour deformity, perforated and implanted in the routine manner. As previously stated, cartilage from negro and Japanese subjects were implanted, together with cartilage from caucasians, into the same caucasion recipients in combined or in separate operative sessions. Results have been uniformly favorable. Some cartilage will

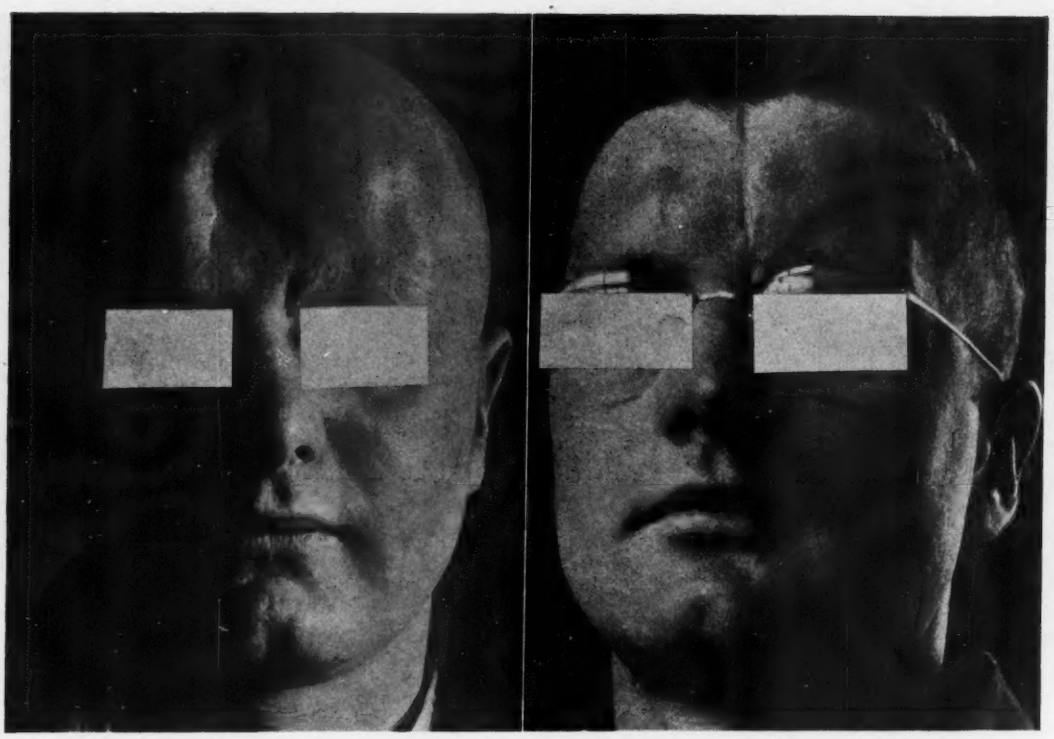

FIG. 8. Patient with extensive depression of forehead following surgical removal of portions of the anterior tables of the frontal bones, subsequent to injury sustained in a motorcycle accident.

FIG. 9. Appearance of patient following implantation of iso-cartilage. Implantation was effected through entrance at the site of the old longitudinal scar on forehead. Patient developed pulmonary congestion at site of removal of cartilage, with uneventful recovery.

exhibit a slight tendency to curling following its removal from the sterilizer after boiling. This is a fortunate occurrence, since it apprises the surgeon the direction of possible post operative curling, and thus yields a guide to the placing of the implant.

HETEROCARTILAGE IMPLANTS

Heterocartilage implants (bovine) hold promise of major importance to cosmetic surgeons for use in locations where a panniculus is desired either as an end in itself, or as an end in combination with the substantive cartilage. Where soft cushiony parts are maldeveloped or become depressed following destruction of soft subcutaneous tissue by trauma or other pathological processes and require elevation for cosmetic improvement, heterocartilage may be implanted for its reaction in producing the fibrotic invasion integral to its encapsulation, and may be removed when the panniculus composing the capsule has attained the desired elevation. Further experimentation can alone determine the quantitative and temporal aspects necessary for accomplishing the desired panniculus

ADVANTAGES

An appraisal of the procedures advocated in this paper reveals definite advantages over the procedures generally in vogue!

1. They give practical expression to the conclusion agreed upon by all cosmetic surgeons that foreign body cartilaginous implants are preferable to viable cartilaginous implants.

2. The methods of preservation and sterilization ascertain the annihilation of viability by rendering the cartilage implant an inert foreign body.

3. They bring into use additional sources of suitable cartilage for implantation, eliminating the need for limitation of cartilage sources to subjects of co-ethnic

Fig. 10. Patient suffered injury in early childhood resulting in depression of the bony interorbital region, the superior portion of the nasal bones, and the superior inner portions of the orbital margins. Subintegumentary fascia was destroyed resulting in adhesion of the integument to the periosteum.

Fig. 11. This illustrates patient's reaction to heterocartilage (bovine) implantation and is not submitted for its cosmetic accomplishment. The implant was well tolerated and produced an overabundance of fibrotic reaction. A single implant was necessary. Human cartilage dimensions proved inadequate for supplying an implant as needed.

descent. Otherwise stated, they permit cartilage implantation from xanthoderms to leucoderms, from melanoderms to leucoderms, from leucoderms to xanthoderms, singly or in combination.

4. These methods of preservation eliminate the need for refrigeration and frequent changing and culturing of the preserving fluid.

5. The boiling extracts any trace of water-soluble proteins that may be present in the scant fibrils or in the lymph channels of the cartilage, and ensures sterilization of the implant.

6. The boiling removes all traces of the preservative, thus removing the possibility of chemical irritation to the bed receiving the implant.

7. These procedures introduce into usage the heterocartilage implant as a means for its reaction-begetting value of producing a panniculus where subcutaneous soft tissue needs filling. They render feasible the use of heterocartilage implants as ends in themselves, or in combination with their use as a means for production of the panniculus.

CONCLUSIONS

1. Implants of boiled human cartilage produce minimal reaction in the host.

2. Ethnic differences within the human genera do not affect transplantability of cartilage. The cartilage from subjects of a given ethnic group is transplantable to subjects of another ethnic group without producing discernible reaction differentials.

3. Cartilage from two subjects each of which belongs to a separate ethnic group is transplantable in combination to subjects who belong to neither of the ethnic groups of the donors, without producing discernible reaction.

4. Heterocartilage (bovine) is transplantable to the human, and holds promise of becoming the implant of choice because of its coefficient of increased reaction in locations where subcutaneous soft tissues require elevation. It may be employed as a means for attaining the elevation of the

soft tissue, or as an end, itself to be retained, or in combination.

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The main indications for bone grafting in the mandibular region are (1) non-union resulting from bone loss, initial or due to sequestration, and (2) mal-union, in association with bone loss, causing dysfunction and deformity.

From "Surgery of Modern Warfare" edited by Hamilton Bailey (The Williams and Wilkins Company).

RUPTURE OF THE LOWER LUMBAR INTERVERTEBRAL DISKS

M. K. KING, M.D.
Senior Surgeon, United States Public Health Service, U. S. Marine Hospital
NORFOLK, VIRGINIA

FIFTEEN years ago in most of our Marine hospitals there was always a small group of patients suffering from a condition which we termed "chronic sciatica" or "chronic sciatic neuritis." There was no specific therapy for this affliction, and it was treated with rest, traction, back supports, physiotherapy, manipulations and various injections in the region of the sciatic nerve. Under this régime some improved but others continued to suffer in spite of all treatment. Some were forced to resign themselves to a life of chronic pain and invalidism.

In 1934, Mixter and Barr[1] presented their classical studies on protrusion of the intervertebral disks as a cause of low back and sciatic pain. The results of this work and later contributions by others have led to a better understanding of sciatic pain. We now believe that primary sciatic neuritis is rare and that chronic sciatic pain is usually produced by a ruptured intervertebral disk.

The ruptured disk syndrome is frequently described as a low back pain with sciatic radiation. While this description is essentially correct, the low back pain has frequently been allowed to dominate the picture. The pain is a nerve root pain with radiation over one of the dermatomes of the sciatic nerve. The causes of low back pain are many and in our experience the percentage due to ruptured disks is small. Less than one patient in fifteen admitted to this hospital for low back pain has findings consistent with a ruptured intervertebral disk. There is little justification for the diagnosis where low back pain exists without sciatic radiation.

PATHOLOGY

The intervertebral disk is composed of a tough, outer fibrocartilage with a soft central portion, the nucleus pulposus. Rupture of the fibrocartilage occurs rather constantly in the posterior and lateral portion at the point where the emerging nerve root crosses the disk. A portion of the fibrocartilage is extruded beneath the posterior longitudinal ligament and may rupture through the ligament to lie in direct contact with the nerve root. The extruded mass of fibrocartilage is forced backward and compresses the nerve root against the lateral margin of the ligamentum flavum. The nerve root is sometimes flattened and may show considerable swelling and inflammatory change. (Fig. 1.)

Approximately 90 per cent of all ruptures occur at the fourth or fifth interspaces.

There is some evidence to show that a partially protruded disk may be replaced by manipulation.[2] Such replacement is certainly impossible after the protrusion becomes complete.

SYMPTOMATOLOGY

A careful history will sometimes elicit a story of repeated attacks of low back pain preceding the onset of sciatic pain; but the sciatic pain may develop with no previous history of backache. It is conceivable that in the early stages of rupture, before nerve root pressure occurs, some back pain might be caused by the local damage and inflammation at the rupture site. Once pressure on the nerve root develops other symptoms are largely submerged. The pain

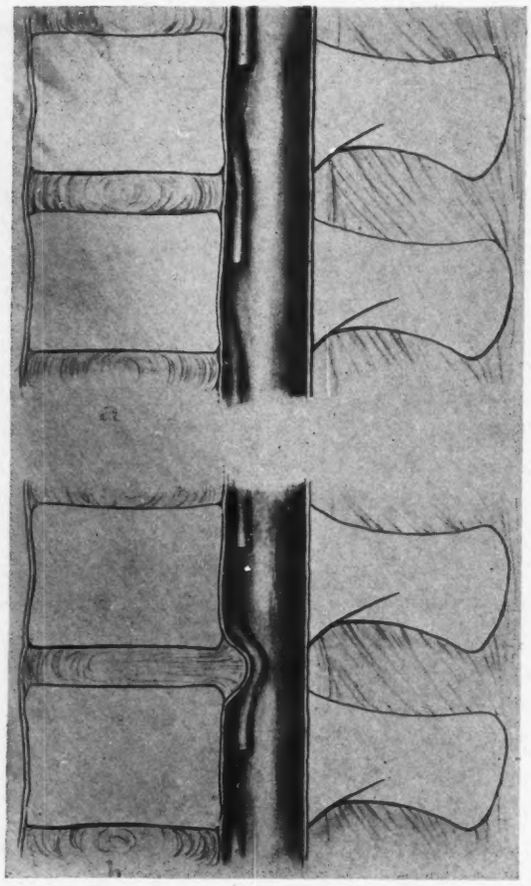


FIG. 1. A, lateral view of spinal cord lying in the bony canal (diagrammatic). The normal relationship of the nerve root to the intervertebral disk is shown. B, here is a moderate protrusion of a ruptured disk pushing the nerve root posteriorly. The ligamentum flavum against which the nerve root would be compressed is omitted for clarity.

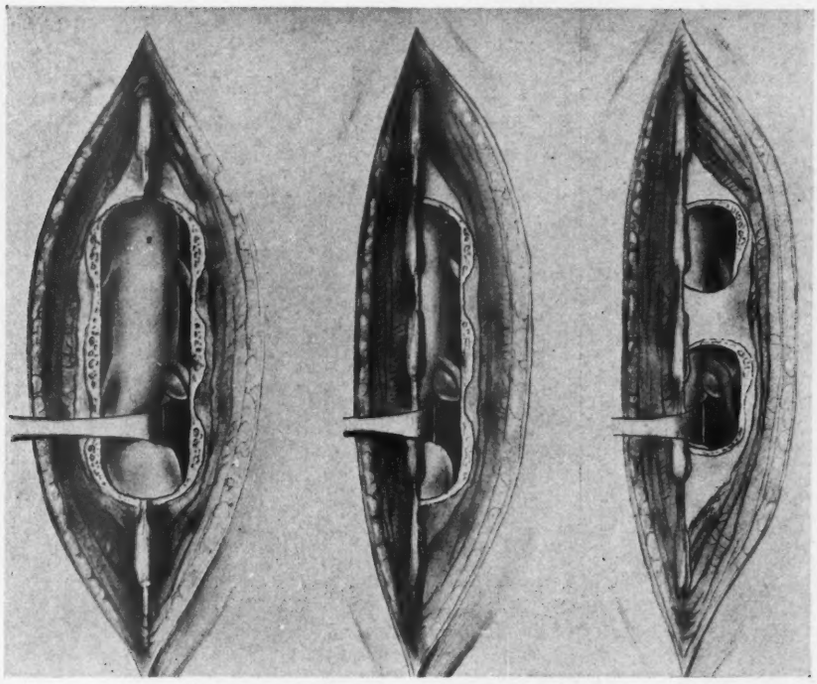
most frequently radiates into the hip or sacro-iliac region. It is this characteristic, the radiation of the pain into the posterior hip, which in the past has commonly led to the diagnosis of sacro-iliac strain. Sacro-iliac strain is now considered a very rare injury, but the diagnosis was quite common only a few years past. The radiation of pain from a ruptured disk may stop at the hip or continue into the leg or foot. A most important diagnostic point is that the pain does not involve the entire sciatic nerve distribution as would occur from a peripheral neuritis. It involves one nerve root and symptoms are confined to this one dermatome. The most commonly involved root is S_1 caused by a ruptured disk at L_5. The pain commonly radiates to the heel, small toe or lateral surface of the foot. If rupture occurs at L_4, the pain may radiate down the lateral surface of the leg to the middle toes or occasionally the great toe. Anesthesia or numbness on the lateral surface of the leg is common in ruptures of both L_4 and L_5. An exaggeration of pain on coughing, sneezing or sudden strain is usually noted. Motor weakness is sometimes present in the calf or hamstring muscles. More than one nerve may be involved in the large disk protrusions and actual paralysis may exist.

The patient usually sits on the unaffected buttock. Bending or straight leg raising causes an exaggeration of pain. The pain is usually persistent in all positions, but lying is somewhat more comfortable than standing or sitting.

Exacerbation and remissions are characteristic of the disease. The cause of such cycles is not well established, but it seems probable that inflammatory swelling in the region of the protruded mass plays some part. The occasional relief afforded by spinal fixation, traction or chiropractic manipulations is perhaps due to replacement of a partially protruded disk.

DIAGNOSIS

Pain is the outstanding characteristic of the ruptured disk syndrome. Pain is out of all proportion to *x*-ray or physical findings. A careful history is therefore essential. A history of injury is present in only 50 per cent of our cases. Following a twisting strain there is sensation of a "slip," or something giving way in the lower back; or symptoms may begin as a vague pain which gradually radiates into the posterior hip and which becomes increasingly severe. Occasionally, pain begins in the lateral calf or foot without hip or back pain. The pain is exaggerated by coughing, sneezing, straining or lifting. There is a tendency to spontaneous remission with or without treatment, but in



A B C

FIG. 2. A, the original operation for removal of ruptured intervertebral disks. The lamina and spinous processes were removed to provide wide exposure. Some spinal weakness always followed. B, hemi-laminectomy, a modification of the original operation, in which half of the lamina and all of the spinous processes were preserved. Adequate exposure was provided, but some spinal instability often followed. C, the operation which is now used. The ligamentum flavum is removed from between the lamina on one side. A small portion of the lamina is usually trimmed away above and below. Adequate exposure is obtained and the stability of the spine is preserved

the more severe cases the pain never entirely disappears.

Physical examination usually shows some decrease in the achilles reflex, diminished sensation along the lateral surface of the leg and ankle, and slight atrophy of the calf muscles. The knee jerks are seldom affected, but secondary atrophy in the quadriceps muscle group is not uncommon. There is usually a list in the lumbar spine to the affected side. Straight leg raising on the side of the lesion is painful. Tenderness to percussion is sometimes present in the lower lumbar region directly over the rupture site.

Rarely there is pain and anesthesia bilaterally if the protruded disk is large, and causes pressure on the cauda equina. If neurological findings are present bilaterally, a tumor rather than a ruptured disk should be suspected. The classical findings are those of unilateral single nerve root pressure usually at L_4 or L_5, and the diagnosis should be made on a neurological basis.

X-ray studies are of value in ruling out primary disease of the vertebrae and structural abnormalities. The films will sometimes show narrowing at the involved interspace, but in general *x*-rays have more negative than positive value in the diagnosis. Myelography is unnecessary and should be used rarely unless the diagnosis is obscure or tumor is suspected. Radiopaque oils are difficult to remove from the spinal canal and myelograms are sometimes misleading. Where a small, laterally placed rupture exists, myelograms may be negative and may actually confuse rather than clarify the picture. If a radiopaque oil is used, pantopaque possesses the advantage over lipiodol of being easier to remove from the spinal canal. Fluoroscopic study of the column of oil is

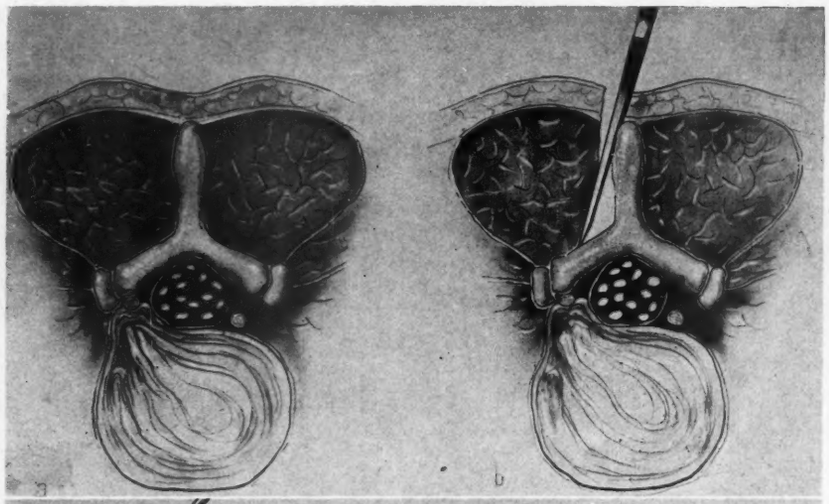


FIG. 3.

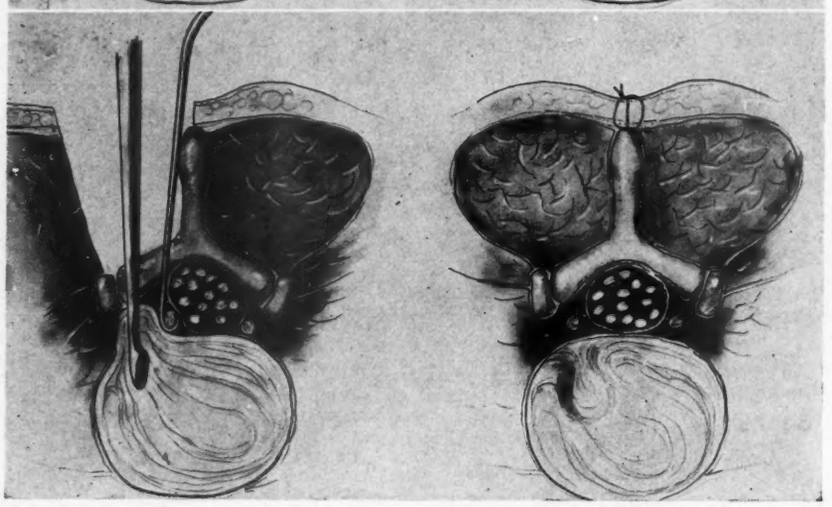


FIG. 4.

FIG. 3. A, sagittal section through lumbar spine. A ruptured intervertebral disk is shown compressing the nerve root on the left. The normal position of the root is shown on the right. The ligamentum flavum is omitted for clarity. B, method of subperiosteal dissection of lumbar muscles and fascia.

FIG. 4. A, the lumbar muscles have been retracted laterally, the nerve root and dural sac retracted medially, and a curette has been passed down into the intervertebral space. B, the protruding portion of the disk has been removed, together with the degenerated central fragments. The nerve root now lies free.

of more value than *x*-ray plates alone. To achieve maximum information the oil should be gravitated up and down the spinal canal under fluorscopic observation and spot films made when a filling defect is noted. After diagnostic studies are completed the iodized oil should always be removed.

TREATMENT

The treatment of a ruptured intervertebral disk should be conservative unless the pain and disability is of sufficient severity to warrant operation. Undoubtedly there are many cases of mild protrusion which have subsided under the usual régimes of rest, physiotherapy and lumbar supports. Such measures should be tried on all patients during the first attack. When attacks are recurrent and severe, operation is the only method of affording permanent relief. The relief is frequently spectacular. Many patients on the day following operation volunteer the information that the sciatic pain has completely disappeared.

The operation itself has been greatly modified over a period of years. In the

beginning a wide removal of two or three lamina was considered necessary. (Fig. 2A.) Considerable back weakness always followed such a procedure unless a spinal fusion was also done. Later the operation was reduced to a hemi-laminectomy in which the spinous processes and articulations were not disturbed. (Fig. 2B.) Back weakness was not so noticeable after this modification was instituted.

In the operation which is now used the ligamentum flavum is removed from between the lamina and only a small portion of the lamina above and below the lesion is trimmed away. The nerve root is retracted, the protruding portion of the disk removed and the intervertebral space is thoroughly curetted. If there appears to be developmental or congenital weakness or excess mobility present, the articular facets are also thoroughly curetted and bone shavings turned down from the lamina and spinous processes. There is abundant evidence to show that after such an operation the spine instead of being weakened is stabilized by fusion between the vertebrae. The patient is usually out of bed in seven to ten days and returns to work in four to six weeks. (Figs. 2C, 3 and 4.)

During the past seven years, we have operated upon one hundred patients for ruptured intervertebral disks. The diagnosis has been confirmed in ninety-one cases. Eighty of the patients in the proven cases have been completely relieved of all sciatic pain. Results in the others have varied from none to almost complete relief. Strangely enough of the nine cases in which no evidence of a rupture was found, three of the patients have been relieved of their pain. There has been little in our experience to justify such diagnoses as hypertrophied ligamentum flavum, concealed disk or disappearing disk. A ruptured intervertebral disk is as readily demonstrable as a ruptured appendix, and unless it can be demonstrated the diagnosis is unwarranted. The three patients who had no ruptured disk yet obtained relief from operation undoubtedly were suffering from nerve root pressure which was relieved at operation. Nerve root pain is occasionally due to spondylolisthesis, bony spurs of arthritic origin and developmental or traumatic defects. Such causes are in the minority and a ruptured disk is the most probable cause where the pain is unilateral, chronic and of great severity.

SUMMARY

1. Some of the more recent concepts in the diagnosis and treatment of ruptured intervertebral disk are presented.

2. Only a small percentage of patients suffering from low back pain have findings consistent with this diagnosis.

3. Myelography has largely been eliminated in the diagnosis and a neurological approach has been adopted, based on evidence of unilateral, single nerve root pressure.

4. Operation should be reserved for those cases in which conservative treatment has failed. The operation itself has been simplified and the period of disability greatly shortened during the past few years.

5. In properly selected cases the results from operation are gratifying and a return to full duty is usually possible.

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ADVANTAGES OF THE GRIDIRON INCISION IN THE TREATMENT OF CARBUNCLES*

URBAN MAES, M.D. AND E. C. HERINGMAN, M.D.
NEW ORLEANS, LOUISIANA

CARBUNCLES are relatively common infections which present a surgical problem of major importance. The severity of these lesions is often augmented by complicating conditions such as diabetes, nephritis and arteriosclerosis. These complications, especially diabetes, have a markedly adverse effect on the healing, morbidity and mortality of such cases.

In the effort to reduce morbidity and mortality and to speed up healing, a great many methods of treatment have been advocated.[1–12] The mere fact that new methods are being evolved constantly implies that there is room for improvement in our armamentarium.

In 1930, one of us (U. M.) suggested a gridiron incision in the treatment of carbuncles in the diabetic. It was observed that despite the type of treatment used, practically all patients developed a central slough which finally became detached, leaving an area which required either a prolonged period for re-epithelialization or the application of skin grafts. It was recalled by the senior author that as an intern he had seen the late F. W. Parham use the gridiron incision and it seemed that healing was much more prompt in such cases.

In the original paper [13] the treatment of carbuncle and diabetic gangrene was discussed. It was pointed out that the basic, underlying pathology of both conditions was quite similar. A spreading thrombophlebitis is apparent in both instances. The "line of demarcation," which is the line of ulceration that separates the living from the dead tissue, can be seen if the patient lives long enough. In the localized gangrene of a carbuncle, there is always a deep red line with a white area just within this line. This line on section shows considerable leucocytic and round-celled infiltration which acts as a real barrier to a free circulation in the inflamed area. With the idea of liberating this constriction and improving the circulation so as to leave a minimum of slough, the use of multiple longitudinal incisions was adopted. We believe the end results in a series of carefully observed patients warrants the presentation of this method of treatment.

When a victim of a carbuncle is first seen, if the carbuncle is large, as many are, the patient seems to be a rather sick individual. The infected area is swollen and very painful, with a number of small openings discharging a very insignificant amount of pus. There is usually some fever and constitutional reaction to the infection. If he is a diabetic, treatment has to be instituted promptly both locally and constitutionally. Diet and insulin are both used as indicated, but we all realize that control of the diabetes is not easy when a patient is running fever. This factor is as a rule promptly controlled when adequate drainage is established, and the elevated temperature reaches normal. Very frequently patients who have required large doses of insulin may be stabilized with attention only to diet once they have become free of fever. This same principle has been found to hold in diabetic gangrene. In fact, temperature elevation as well as time element have always had some prognostic significance in these cases.

With a fever up to 102 or above in either diabetic gangrene or carbuncle we have

* From the Department of Surgery, Louisiana State University School of Medicine. Read before the Western Surgical Association at Chicago, Illinois, November 30, 1945.

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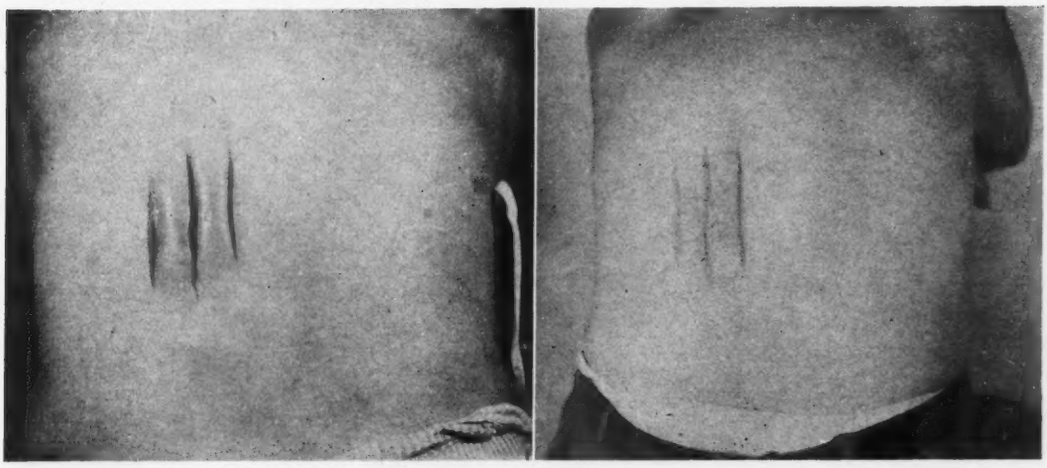


B C

FIG. 1. A, original lesion; moderately sized carbuncle on back. B, gridiron incision fourteen days later. Note clean appearance with evidence of healing; C, incisions healed in six weeks.

learned to give a guarded opinion as to outcome. It has been stated that insulin loses 50 to 75 per cent of its efficiency in the face of temperature elevation. This means that the diabetic with an infection has a double burden to bear and must be promptly, energetically and intelligently treated. The dual burden can be borne only for a limited time.

In caring for carbuncles especially in diabetic patients, anesthesia is an important consideration. Local anesthesia seems obviously contraindicated. Ethylene has been our choice in most instances, or cyclopropane may be used. The operative procedure is brief. We can thus avoid the use of ether to which there are the usual objections.

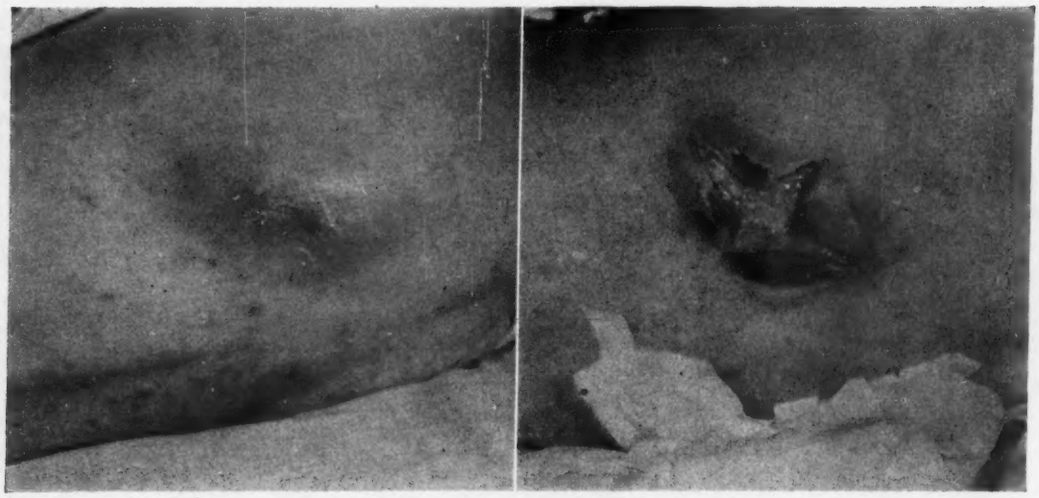
OPERATIVE PROCEDURE

1. Multiple longitudinal incisions are made about 1 to 1½ inches apart. The incisions must extend beyond the leucocyte barrier into normal viable tissue in order to prevent interference to circulation and to help maintain viability of the newly created skin bridges.

2. Bleeding as a rule is brisk but is easily controlled by gauze packing which is left in for twenty-four hours.

3. Wet dressings are applied to facilitate drainage.

4. Packing is removed in twenty-four hours and subsequent treatment has varied with the individual surgeon. Azochloramide irrigations or compresses, 1 per cent carbolized solution, sulfanilimide and dry



A B

FIG. 2. A, original lesion; moderately sized carbuncle on back. B, cruciate incision twelve days later. There is no evidence of healing.

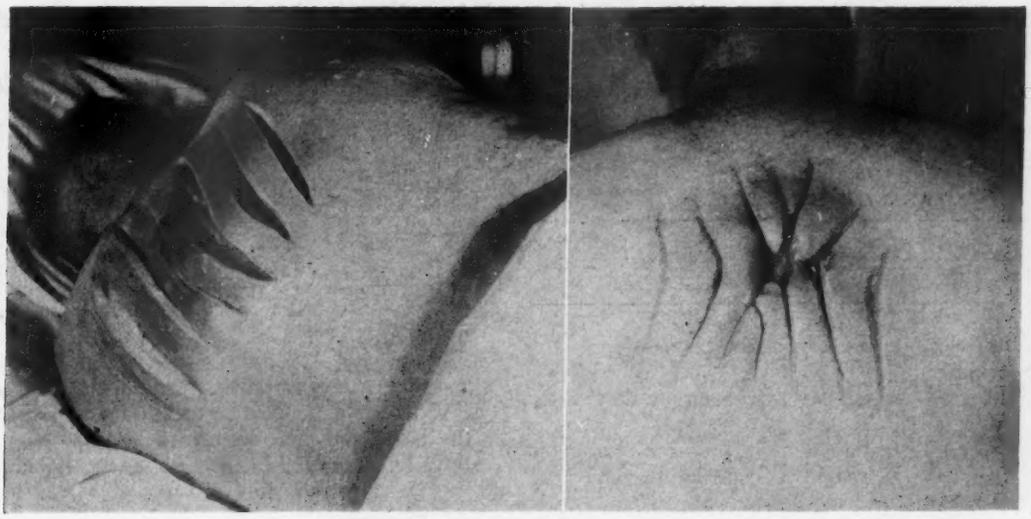
A B

FIG. 3. A, gridiron incision forty-eight hours after admission and treatment of huge carbuncle. B, same incision ten weeks later showing almost complete healing with no tissue loss.

gauze, have all been used without any great difference being noted. When the original packing is removed, it is well to place small fine mesh strips of vaseline gauze between each of the incisions to prevent agglutination of the edges.

5. Penicillin is now a routine measure but has not been used long enough for a full evaluation of its benefits.

In the past five years we have observed 211 cases of carbuncle. Of this group 102 patients were treated by the gridiron incision and 109 patients treated by other methods. The average healing time in uncomplicated carbuncles treated by gridiron incision, that could be followed completely, was forty-three days, whereas fifty-six days were required for complete healing in similar cases treated by other methods. In diabetes and other complicated cases, the healing time was considerably prolonged. It is interesting to note that in general the carbuncles treated by the gridiron incision were larger than those treated in other ways. Despite this fact, the healing time was shorter. While this difference is not great, we believe it offers an advantage in the choice of methods for the care of these individuals.



A B

FIG. 4. A, large carbuncle of back treated by means of gridiron incision. Photo taken forty-eight hours after admission; two skin bridges show signs of gangrene at the center. B, same patient ten weeks later; central area of two skin bridges has sloughed out; defect is closing up rapidly with a minimum of tissue loss and scarring.

The outstanding advantage of the gridiron incision is derived from the fact that there is a minimum amount of tissue loss and deformity. This can be shown best by pictures taken of actual cases. The three patients with large carbuncles shown in Figures 1, 3 and 4 were treated with gridiron incisions. For the purpose of comparison, Figure 2 shows a patient treated by means of a cruciate incision. The carbuncles pictured in Figures 1 and 2 were somewhat similar in size and location. However, when Figure 1B is compared with Figure 2B, the advantages of the gridiron incision are well demonstrated. Although the time element is approximately the same in both cases, the healing is progressing more rapidly in the former. The multiple incisions are closing with a minimum of scar and tissue loss, whereas the cruciate incision gives no evidence of healing.

Figure 4 shows a patient who applied for treatment after several weeks of self-therapy. The central area of the carbuncle was gangrenous when the incision was made. This caused a slough in two skin bridges. Nevertheless, healing has progressed rapidly, and the defect is closing with a minimum of tissue loss. The results obtained in Figures 1 and 3 can be expected when necrosis of the skin does not occur. It is well known that extensive tissue slough and skin necrosis take place when carbuncles are allowed to go untreated too long a time. Early drainage of these lesions cannot be stressed too highly, because it plays an important rôle in the ultimate viability of the skin bridges. This is especially significant in patients who are diabetic.

The mortality figures in this series of 211 cases are of interest. There were no deaths in 127 uncomplicated cases of carbuncle, regardless of the method used in treatment. However, in the forty-seven complicated cases treated by the gridiron incision, there were six deaths with a mortality rate of 12.7 per cent. In the thirty-seven complicated cases treated by other methods there were three deaths with a mortality rate of 8.1 per cent. Statistically, this difference is not significant. The overall mortality rate for 211 cases was 4.3 per cent. Table 1 gives an analysis of the deaths in this series. We believe that it is especially important to note that six of the nine deaths occurred in patients with diabetes. This serves to reemphasize the serious prognosis in these cases. The

4.3 per cent mortality figure is too high, but until we educate our patients to apply for earlier treatment we will be working under a handicap.

TABLE I
ANALYSIS OF DEATHS

Case No.	Cause of Death	Type of Treatment
87	Diabetes—coronary occlusion	Gridiron incision
62	Diabetes—cardiac failure	Gridiron incision
63	Diabetes—uremia	Gridiron incision
73	Diabetes—bronchopneumonia and meningitis	Gridiron incision
81	Diabetes—pernicious anemia and heart disease	Gridiron incision
85	Septicemia	Gridiron incision
175	Diabetic coma	Conservative Management
210	Septicemia and brain abscess	Single incision
187	Psychosis—pulmonary collapse	Single incision

Mortality 4.3%.

On the basis of our study of 211 cases of carbuncle the advantages of the gridiron incision can be summarized as follows: (1) It provides for adequate drainage; (2) it creates viable skin bridges which act as grafts to cover the defect; (3) it heals with a minimum of tissue loss, scarring and deformity; and (4) it requires fewer days for complete healing.

The authors are indebted to W. B. Stewart of the Art Department and J. H. Phillips for their invaluable assistance in photographing and collecting material.

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LATE REPAIR OF TENDONS IN THE HAND*

GEORGE V. WEBSTER, M.D.
Formerly Commander in the Medical Corps, U.S.N.R.
PASADENA, CALIFORNIA

MEN who work with machinery or who handle sharp objects are constantly subject to injuries of the hand. Thus, quite apart from combat wounds, military personnel sustain a large number of injuries to the tendons of the hand which parallel the injuries occurring in industrial accidents. The results of primary tendon repair are frequently disabled hands which require secondary operation.

RESULTS OF PRIMARY TENDON SUTURE

In spite of all that has been written about proper methods of primary tendon repair, errors are committed with such frequency that poor results are the rule rather than the exception following initial tendon suture. Suture of extensor tendons is most apt to give a good result while the repair of flexors is much less successful. Flexors which have been sutured at the wrist give the best results (Fig. 1) while the result of repair in the palm is not as good.

Primary suture of flexor tendons in the fingers still meets with failure at the hands of all but a few experts, and most of these cases result in disabilities which require late plastic repair. (Fig. 2.)

The reasons for poor results in primary tendon suture are: (1) anatomical, (2) bacterial, and (3) surgical.

Anatomical. The flexors are more powerful than the extensors and thus overcome adhesions which form about the extensor tendons. In a large measure this accounts for the ease with which function returns to repaired extensor tendons. In addition, the absence of tendon sheaths about the extensors, except beneath the carpal ligament, allows more ready movement of a repaired tendon in the areolar tissues. One further anatomical point predisposing to good extensor function is the "straight-line" pull of the extensor tendon over the dorsum of the metacarpals. The extension of the digital portion of the extensors is so coordinated with the action of the lumbrical and interosseus tendons that considerable movement is often possible by compensatory action of these small tendons when the extensor is adherent.

The flexor tendons show only slight differential motion at the wrist, differentiating into more individually functioning tendons in the palm, and supplemented to a considerable degree by the lumbrical muscles. Thus, acting as a unit, they can still give good function although they are considerably scarred. (Fig. 1.) Aiding their return of function, following primary suture, are the flexors and extensors of the wrist which are powerful and tend to stretch adhesions in the flexor tendon compartment at the wrist. The tendon sheaths at the wrist are more gross structures and do not sharply circumscribe an individual tendon as they do in the fingers. The pull of the flexor muscles is again exerted in a "straight-line" at the wrist so that all of the muscle power can act directly on the adherent portion of the tendon, loosening binding adhesions.

In the palm, adhesion of a flexor tendon following primary repair is more disabling because motion of the tendon is in exact proportion to the degree of flexion of the individual finger. The pull of the flexor muscle is nearly straight; but when the

* From the Division of Plastic and Reconstruction Surgery, Department of Surgery, National Naval Medical Center. The opinions or assertions contained herein are the private ones of the writer, and are not to be construed as official or as reflecting the views of the Navy Department or the Naval Service at large.

A B

FIG. 1. Patient C. Result three months after primary suture of flexor tendons at the wrist following a self-inflicted gunshot wound (.45 calibre) which passed completely through the wrist, tearing tendons to shreds. Although much scar tissue undoubtedly followed this repair, the result is excellent.

wrist is flexed, power of the muscle is diminished where it pulls through the angle of flexion. Thus, there is not quite so much force exerted on the adherent tendon when the wrist is flexed. There are no tendon sheaths in the palm except for the little finger and the thumb and distal to the distal palmar flexion crease for the tendons of the index, middle and ring fingers. Repaired tendons, then, glide in the areolar tissue which surrounds them.

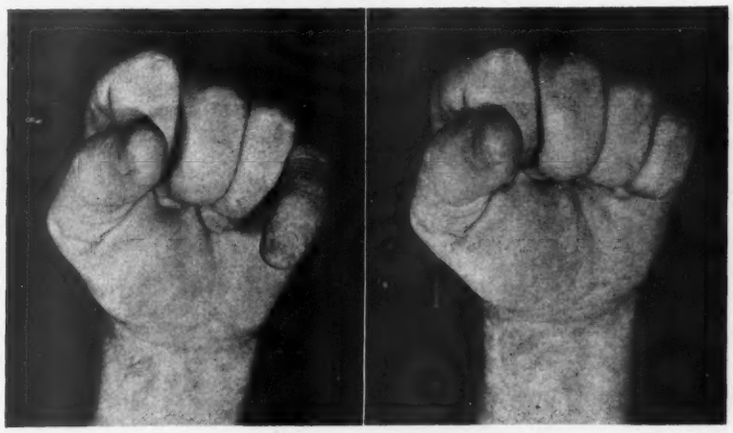
In the fingers and thumb, the tendon must "pull around a corner" and is thus equipped with a gliding synovial sheath and lies in a firm tunnel of unyielding connective tissue. Primary repair of a tendon within these tunnels is followed by swelling of the tendon and, since the tunnel is unyielding, necrosis of the tendon occurs. The result is replacement of the tendon by scar and no function can take place. If the sublimis tendon is removed and only the profundus is repaired, and in addition the tunnel is split along its side or unroofed over the tendon suture line, necrosis does not occur but some adhesions always form. The pull of the flexor muscle, since it must pull through an angle, is never as effective in overcoming adhesions as it is in the palm and wrist.

Bacterial. Tissue reaction to the initial injury and the surgical repair is greatly magnified by bacterial contamination. Koch has emphasized the necessity for covering the wound with a sterile dressing as early as possible to prevent further contamination of the wound with bacteria from the nose and throat of those who examine the wounds. The first six hours after injury have been considered the period of maximum safety, and repair after this time has been felt to be contraindicated. With the use of systemic chemotherapy with sulfadiazine and penicillin, it has been found safe to undertake some repairs at a longer period after injury, up to twenty-four hours. Nevertheless, this extended time period should be utilized only for extensor tendons or for flexor tendons severed at the wrist or in the palm.

Thorough soap and water cleansing of the entire hand and forearm, careful débridement of dirt and devitalized tissue and good skin preparation, added to the strictest aseptic technic in the operating room, will reduce bacterial contamination, and careless, haphazard attention to these procedures will increase bacterial contamination and produce a poor result.

A B C

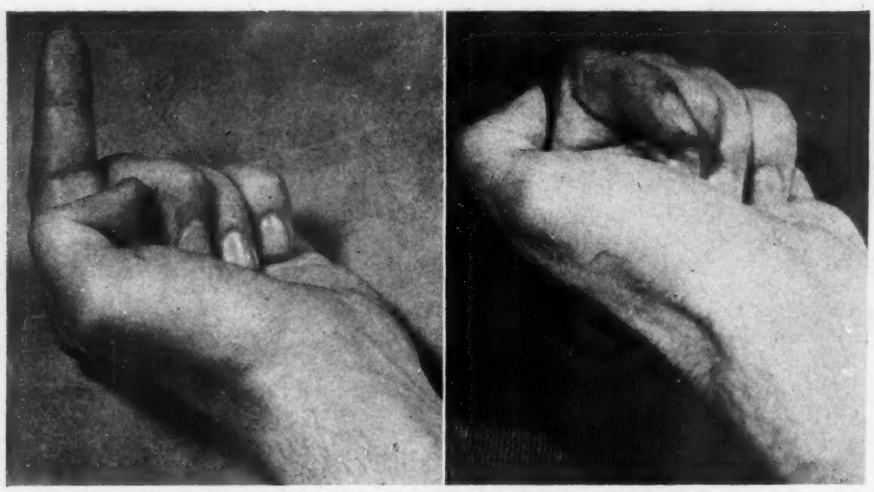
FIG. 2. Patient E. A, unsuccessful result following primary suture of flexor tendons of the right ring finger performed elsewhere. The affected finger is inflexible except for the metacarpophalangeal joint, which is moved by the lumbrical and interosseus muscles B, result three months after total replacement of the scarred flexor tendons by a tendon graft. There is good movement in the proximal interphalangeal joint, but the terminal phalanx does not flex. C, result at eighteen months; good function has been restored but perfect flexion into the palm is still not possible.



A B

FIG. 3. Patient W. A, preoperative limitation of flexion of little finger due to adhesion of the sublimis tendon within the tendon sheath at the level of the proximal phalanx. B, result following excision of both sublimis and profundus tendons and replacement with a tendon graft from palm to finger tip. Such a complete return of function, with extreme flexion of the terminal phalanx, is the exception rather than the rule in tendon grafting.

Surgical. The causes of failure in primary suture of tendons in the hand are all too often due to poor surgery. The errors extend all the way from poor surgical judgment of the patient's general condition to failure in the many minute details of surgical technic which have been so liberally discussed in the surgical literature for many years, especially by Bunnell, Koch and Mason. Wrong incisions continue to be a major cause of crippling deformity. Unnecessary trauma at operation, use of too gross suture materials, operating in a bloody field without a tourniquet, inadequate suture technic and too early motion are but a few of the faults responsible for non-functioning primary tendon repairs, so that on the surgeon himself



A B

FIG. 4. Patient B. A, limitation of all motion of index finger due to severed flexor tendons at the base of the finger. B, function one year following total excision of scarred tendons and replacement by a tendon graft. Flexion is almost complete.

must fall the responsibility for many failures. In all fairness, however, it should be stated that in a good number of cases, in spite of the application of the very best judgment and skillful technic, failures can and do occur.

LATE TENDON REPAIR

If no initial surgery has been performed and the wound has been closed per primum, or if initial surgery has been skillful and gentle, yet a non-functioning result has occurred, the chances of obtaining a good result from late repair are best. If infection has occurred, foreign bodies have remained in the wound or multiple surgical procedures have been performed, with resultant fibrosis, late tendon repair offers only a fair chance for recovery of function. If fingers have been ruthlessly opened by the primary operator, cutting across flexion creases at right angles and destroying the "pulley" mechanism in the fingers, little hope can be given for restoration of function to a normal state. A moderate number of these cases can be improved by excision of all volar scar and replacement with a pedicle flap of skin and fat, beneath which a tendon graft can glide, but results in these prolonged operative repairs are none too good, even in the hands of the most skilled operators.

Fingers in which joints are stiff, nerves are severed and other serious defects are present should not be considered suitable for late tendon repair. If the defects cannot be corrected by splinting, exercise, physiotherapy or surgical interference, the offending fingers should be amputated and the hand revised to make the most of its remaining functional parts. Many a patient, reluctant at first to part with a crippled digit of this type, begs to have it amputated after a trial at work.

A hand with flexible joints, intact nerves and good circulation presents the ideal situation for late tendon repair, and improvement almost always follows plastic reconstruction. If all such cases are analyzed on a purely objective basis, however, it must be admitted, even by the strongest advocates of tendon surgery, that excellent results, with absolutely perfect return of function, are rare indeed with flexor tendons. (Fig. 3.) If a useless digit is converted to a useful one, if the strength of grip is returned to normal and if the capacity of the hand for useful work approaches normal, the patient is greatly pleased and the operator should consider his repair successful. (Figs. 2, 4 and 6.)

A final evaluation of results should be deferred for a year to eighteen months

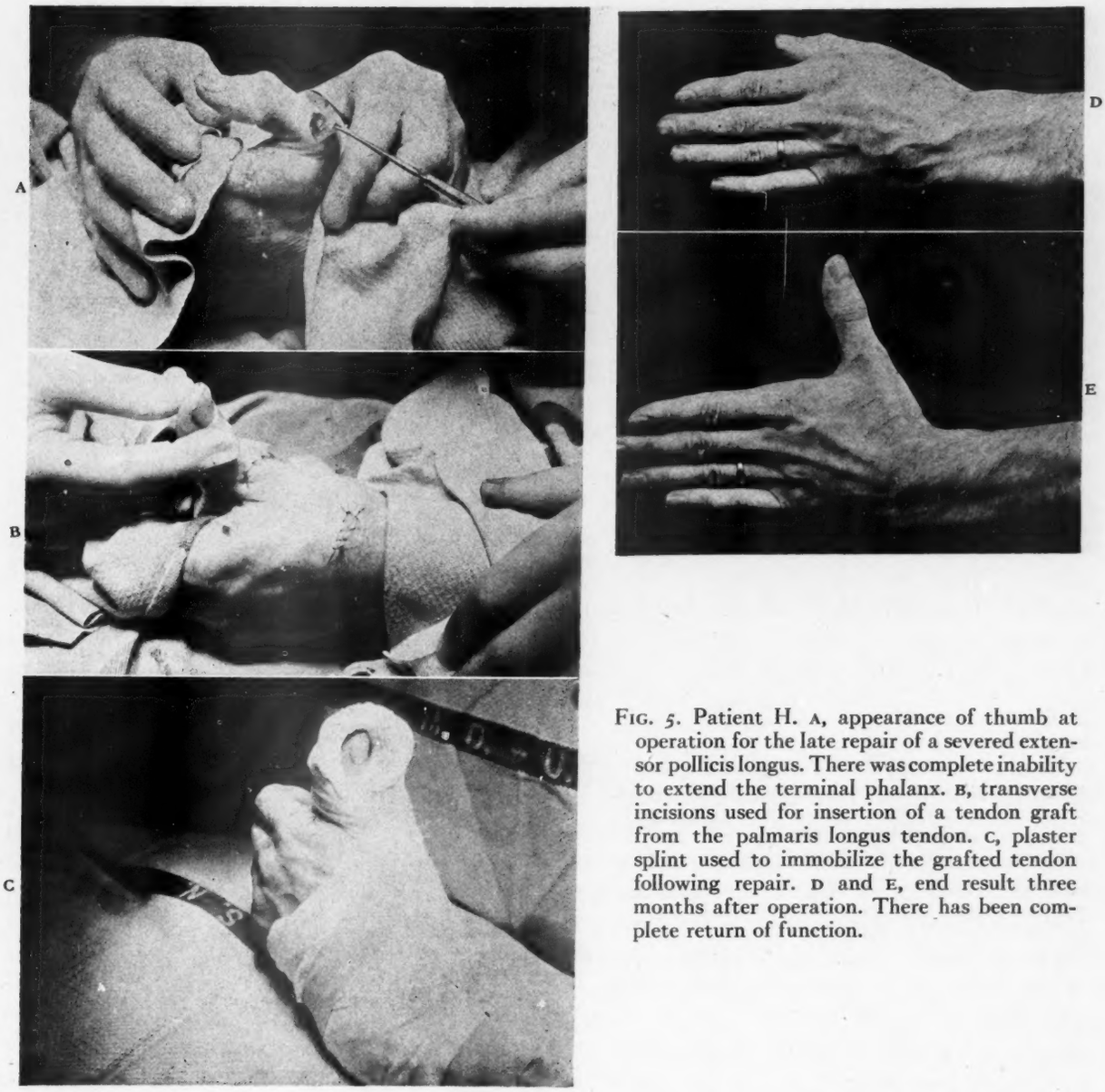


FIG. 5. Patient H. A, appearance of thumb at operation for the late repair of a severed extensor pollicis longus. There was complete inability to extend the terminal phalanx. B, transverse incisions used for insertion of a tendon graft from the palmaris longus tendon. C, plaster splint used to immobilize the grafted tendon following repair. D and E, end result three months after operation. There has been complete return of function.

before any case is called a failure. Tendons, like bones, align their structure in the direction of the stress which is put upon them, and often a finger which flexes poorly at three months will be improved at six months and with active exercise it may be moving well six months to a year later. Premature re-exploration of an operated finger may forfeit all chance of final improvement. (Fig. 2B and C.)

Technic. The sterile, healed hand which needs late repair presents the surgeon with an immaculate, well nourished complex interior. His knowledge of anatomy should be absolute. His background of surgical training and experience should be great enough to cope with any surgical complexity which may arise. Meticulous skin-preparation and aseptic technic must, of course, be flawless, and the surgeon should approach the tissues with positive clarity of purpose, yet maintain an artful delicacy in all his movements.

A bloodless field, secured by a pneumatic blood-pressure cuff tourniquet about the upper arm, gives necessary visibility and has made possible all successful surgery of the hand. Although some authors have repeatedly left tourniquets in place for several hours, it seems more in keeping

A B

FIG. 6. Patient O. A, preoperative view of crushed right hand with adhesion of all extensor tendons as well as total loss of function of the flexors of the little finger. B, postoperative result one year following complete release of extensor adhesions, repair of malunited metacarpals and tendon graft to the flexors of the little finger.

with basic laws of cellular physiology to allow a "rest period" of ten minutes out of every hour during which the tourniquet is deflated and normal circulation is restored. At the end of this time the arm is elevated for a few moments and the tourniquet is re-inflated.

Incisions should be thoughtfully planned, keeping in mind the exposure necessary for the particular tendons involved and the necessity for conformation with the normal folds and flexion creases of the skin. Extensor tendons can be repaired through two or more transverse incisions, conforming to the normal skin lines of the dorsum of the hand. (Fig. 5.) Flexor tendons are exposed in the fingers through mid-lateral incisions, which lie dorsal to the digital nerves and vessels, and in the palm through a broad based palmar flap, the margins of which coincide with or parallel the flexion creases. Supplementary incisions in the wrist are made transversely when necessary.

Scars on the surface of the hand may alter elective lines of incision and one must be prepared to utilize a thick-split skin graft for closure, if necessary, where scars have been removed. If scarring is extensive, preliminary skin-grafts should be done at a separate operation, using pedunculated flaps of skin and fat when the scar directly overlies a damaged tendon.

All deep scar should be removed, but careful preservation of tendon sheaths should be maintained, if at all normal. Opening the sheath from the side permits preservation of the volar gliding surface. In the wrist, excision of excessive scar alone is frequently all that is necessary to give a good result. In the palm and in the fingers the sublimis tendon is routinely excised and reparative efforts concentrated on restoration of the profundus tendon alone. The long flexor of the thumb is treated as if it were a profundus tendon, which, in effect, it is.

Extensor tendons are exposed and repaired by simple approximation, if possible. Retraction of tendon ends is rarely encountered in the fingers, but moderate retraction is to be expected where the extensors overlie the metacarpals.

A segment of palmaris longus tendon is flat and approximates the size of the extensors. Thus, it makes an ideal graft for the shortened tendons. The long extensor of the thumb retracts much farther than those of the fingers when they are severed, and hence almost always requires a tendon graft. (Fig. 5.)

An alternative method is a tendon transfer from the extensor carpi radialis brevis tendon. Adhesions of the extensor tendons to the underlying metacarpals must be freed and occasionally insulated by free

fat grafts to prevent re-adhesion. Concomitant mal-union of metacarpal fractures should be corrected at the same time. (Fig. 6.)

Flexor tendons are repaired by direct approximation in the wrist and hand, whenever possible, flexing the wrist during healing and relying on later active exercise and stretching to restore normal functional length of tendon. If retraction of the proximal tendon end is very great, a tendon graft is always used.

In the fingers, flexor tendon repair is almost always performed by the use of a tendon graft. The basic principles behind tendon grafting for such defects are so thoroughly emphasized by Bunnell that his writings should be thoroughly studied by all who intend to practice tendon grafting.

Severed nerves should be repaired by freshening and approximation whenever possible. Free nerve grafts from the sural nerve in the leg are used with success in a moderate number of cases.

Closure of the wounds should be accomplished without buried sutures in the subcutaneous tissue, to minimize foreign body reaction, and the skin edges should be carefully approximated. Pressure dressings of evenly distributed, fluffed gauze assure the best conditions for healing. Splints are used to maintain a relaxed position for the tendons. (Fig. 5.) Plaster of Paris bandages provide the most universally useful splints; but metal splints, made individually before operation, are sometimes used and have the advantage that they can be boiled and applied to the hand while the wound is still open, whenever this is desirable. In the case of combined osteotomy and tendon repair, it is very helpful to be able to check the position of the bony fragments before the wound is closed and it is known that the position will not change throughout the healing process.

When the patient is returned to bed, the arm is elevated on three pillows to aid venous and lymphatic return. Circulation can be checked easily if finger-tips are left exposed when the dressing is applied. The first dressing of the wound is usually left until the eighth or tenth day, at which time all sutures are removed.

After-care. Although temptation on the part of both surgeon and patient may be great, movement of the repaired tendons before three weeks should not be permitted. Mason and Allen so conclusively proved the length of time necessary for healing, that there should be no question of earlier movement. Active exercise alone should be allowed from the fourth to the sixth postoperative weeks, after which time both active and passive exercise, physiotherapy and massage may be used vigorously, but always within the limits of tolerance of the patient.

If initial motion is unduly slow to return, a finger can be started into flexion by traction. This can be accomplished with a metal forearm splint with an "outrigger" of rigid wire rod, bent to obtain a pull in the proper direction. A leather stirrup or an old glove can be used to grip the finger and this can be removed periodically for active exercise and physiotherapy. It is our impression that fixed traction, with inelastic cord, is better than the use of elastic traction with rubber bands. The firm, fixed traction is made tighter each day, and the gradual steady traction does not produce the soreness and stiffness in the interphalangeal joints which is so common with elastic traction.

Time and willing cooperation on the part of the patient are the major factors in obtaining successful results in late tendon repair. A patient must be willing to utilize force, even though it hurts a little. He must be patient enough to spend tedious hours of active exercise and he must not be discouraged by the sometimes snail's pace to recovery. When all of these conditions have been satisfied the surgeon will have reconstructed, in a slight degree,

the wonder of the gliding mechanism in the finger.

CONCLUSION

Late repair of tendons in the hand is necessary because primary repair is often unsuccessful. The reasons for poor results of primary suture are anatomical, bacterial and surgical. Cases in which late repair is contemplated must be carefully selected. Details of technic and after-care are important, but also the cooperation of the patient must be excellent if good results are to be obtained. Good results are frequent, but excellent results are rare.

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If an extensor tendon is severed, a simple yet practical method is to suture the cut ends with stainless-steel wire, the same suture being made to unite the skin as well. Adequate splinting will prevent the tendon ends from pulling apart.

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SPLENECTOMY IN FAMILIAL HEMOLYTIC JAUNDICE*

STUDY AND CURE OF PATIENT WITH NORMAL ERYTHROCYTE FRAGILITY AND OTHER UNUSUAL FEATURES

CAPT. LESTER H. EISENDORF AND MAJ. JAMES R. BROUN
MEDICAL CORPS, ARMY OF THE UNITED STATES

FAMILIAL hemolytic jaundice has been recognized as an entity ever since its first accurate description by Minkowski[1] in 1900 when he emphasized the familial tendency of the disease. Its salient clinical and laboratory features are now so well defined that few errors of diagnosis occur. As early as 1887, Spencer Wells, of England, carried out the very first splenectomy for this condition without understanding its rationale. His patient was examined forty years later by Lord Dawson[2] and found to be well. Today, while the beneficial effect of splenectomy is widely recognized, the reason for the beneficial effect still remains somewhat obscure.

The etiology of familial hemolytic jaundice continues unknown. Some workers, including Haden[3] and Naegaeli,[4] have attributed the fundamental pathologic changes as being due to the production of an overly fragile microspherocyte in the bone marrow. They considered the splenomegaly, anemia and icterus as secondary to these abnormal cells. On the other hand, Doan, Wiseman and Curtis[5] believed that the primary development of pathologic phagocytic action in the spleen, itself, causes secondary changes in the marrow and the erythrocytes. The ideas of Wiseman, Doan et al. seem more tenable to us since splenectomy affords complete cure, as many of the blood changes may persist for many years.

More recently, other important contributions as to the cause of these hemolyses have been suggested. Of these, one of the most significant ideas is that of Damshek, Schwartz and Gross[6] who conclude the following: (1) Isohemolysins of the immune body type were discovered in the serum of three cases of acute hemolytic anemia. (2) Anti-guinea pig hemolytic serum was prepared by the injection of guinea pig red cells into rabbits; this serum possessed all of the immunologic properties of the serum found in clinical cases. (3) Hemolysis of the red cells of the guinea pig *in vivo* followed the injection of the serum. (4) By varying the dosage of the anti-guinea pig serum, various types of hemolytic syndromes were produced, formulating hemolytic anemia with hemoglobinuria, acute hemolytic anemia, and subacute hemolytic anemia. (5) Various types of blood pictures could be produced at will—microspherocytosis, increased erythrocyte fragility, reticulocytosis and pseudomacrocytic blood pictures. (6) Their observations point to the conclusion that spherocytosis is due to the activity of hemolysin and not to an abnormal anatomic peculiarity or to a disturbed formation of cells in the bone marrow. Since increased fragility is the function of the increased thickness of the red cells, it is dependent upon the same cause. (7) They believe that hemolytic syndromes are due to hemolysin, possibly of different types and of course, in different amounts, functioning slowly in some cases and violently in others. The various blood pictures of the hemolytic anemia are in all probability due to the effect of varying activity of the hemolysis and modified by the individual variations. (8) Since the

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experimentally produced hemolytic syndromes and the numerous clinical types are closely comparable, the chief difference of the clinical syndromes may be a matter of the amount of functioning hemolysin present.

While the idea of a hemolysin in the serum being responsible for the acute hemolytic anemia is a very attractive one, it has not been borne out by other investigators.

It is of interest to note that two features of the disease, while generally recognized as being necessary to diagnosis, may be absent. They are, first, the presence of relatively normal indices of red cell fragility and second, the absence of reticulocytosis. We believe our case falls in the category of the former and represents one in which there is no appreciable alteration in red cell fragility, and yet has sufficient of the other important clinical findings to warrant a diagnosis of familial hemolytic jaundice as confirmed by the pathologist.

While the significance of the increased fragility of the red cell has been recognized as early as 1907, when Chaufford[7] pointed out its presence, other recent investigators have shown that it may not be present and that normal fragility may occur. Bockus and Tuman[8] state that while microcytosis and increased fragility are the most constant features of this disease, the fragility has been found to be normal in about 10 per cent of the cases. Gännslen[9] expressed the same opinion, too, finding normal fragility in 10 per cent of his cases. Hurley and Moore[10] reported a case with normal fragility and normal reticulocyte count cured by splenectomy. Similarly, Dawson[11] found normal fragility in five out of forty cases studied.

Another cardinal feature of the disease process is the presence of so-called microspherulosis. This was first described and its significance stressed by Naegaeli.[12] Thompson[13] states the opinion that spherical microcytes are as pathognomonic of this disease as sickle cells in sickle cell anemia. This opinion is open to controversy. It can readily be understood why globular cells or spherocytes are more readily affected by hypotonic solution than a normal erythrocyte which is biconcave. This is based on the physiologic observation that when normal biconcave erythrocytes are placed in hypotonic solution they swell and become readily globular. Hence, if the cell is already globular, its tendency to increased fragility is readily understood. In physiologic experiments, Castle and Daland[14] conclude the following: Differences in the susceptibility of various types of erythrocytes in hemolysis to hypotonic salt solution are due largely to differences in form and not to differences in osmotic behavior. Direct microscopic observations indicate that (1) hemolysis with a given type of erythrocyte is associated with the assumption of a spherical form in hypotonic plasma. (2) The more susceptible the erythrocyte to hypotonic hemolysis, the less hypotonic is the plasma necessary to cause the assumption of the spherical form.

Of additional interest is the relation of red cell diameter and fragility to hypotonic salt in various mammals. The following table of Vallery Radot[15] is rather graphic (Table 1.)

Table 1

	Dia. of R.B.C. in Microns	Hemolysis Begins % Na. Cl. Sol.
Man	7.6	.42
Guinea pig	7.5	.44
Monkey	7.2	.44
Dog	6.6	.50
Rabbit	6.3	.52
Horse	6.2	.54
Rat	6.0	.54
Cat	5.6	.60
Goat	5.3	.72

From the above we can readily see that the smaller the cell the more easily it is affected by hypotonic solution of sodium chloride.

Apparently then the significant defect which forms the basis of familial hemolytic

anemia is the presence of microspherulosis. However, the direct etiology of the defect remains unknown at present. It has been shown, however, that the spleen itself is not responsible for the increased fragility because in many instances following splenectomy, the fragility index remains high. Despite this, however, splenectomy resulted in very distinct relief of our patient's condition as manifested by the return of the red blood cells to within normal limits, absence of icterus and clinical well being.

We believe then that this case represents the following unusual features: (1) Normal erythrocyte fragility, (2) presence of very few circulating microspherulocytes. (3) Cases with these characteristics are rather infrequent in the literature. We believe that this patient is a true case of familial hemolytic icterus and has apparently rapidly been cured by splenectomy.

CASE REPORT

W. A., a white male, age twenty-two, a mail clerk, was admitted to the hospital on March 19, 1945, with the following history: He stated that he was in relatively good health until October, 1942. At that time he noticed marked lassitude and weakness. He consulted a local physician who made the observation that he was jaundiced and also noticed that he had enlargement of his spleen. A blood count taken at that time disclosed the presence of anemia. Apparently, it was thought that he was suffering from pernicious anemia and consequently, his physician put him on intramuscular liver extract. He continued on this management for about a month with slow but apparently distinct improvement. Following this, he stated, the next month he felt much better and was able to return to work. He believed that the jaundice was still present but diminished. He then continued to work along until January, 1943, at which time he was inducted into the military service. He was able to carry on his regular routine army duties and was able to undergo basic training and continued along in army service until August, 1943, at which time he developed another episode of weakness with exacerbation of his jaundice. At this time he was hospitalized at the Station Hospital at Fort Bliss. Studies there disclosed the presence of splenomegaly, anemia and jaundice. He was advised that he was probably suffering from a congenital type of hemolytic anemia, and it was suggested or recommended that he undergo splenectomy. He was discharged from the service at this time. Following discharge from the service, despite the absence of any specific therapy, he slowly improved, was able to return to work and then worked on and off for the next year or so until December, 1944. At this time he again developed a recurrence of his marked asthenia and lassitude. He was unable to stand very long. He was again studied by a local physician and was again advised to undergo splenectomy.

His past history was quite significant, particularly as respects his family history, as follows: His mother, it was said, suffered from chronic anemia with splenomegaly. She had been under management with liver extract for some time. A report of her peripheral blood study will be made subsequently in the course of this discussion. His father was living and well. The maternal grandmother was stated to have had a similar condition to that which existed in the patient's mother, i.e., jaundice with anemia. The exact origin of this was never evaluated. There were two brothers and three sisters living and well. However, one of the sisters had an anemia of unexplained origin. There was no apparent anemia or splenomegaly that had been noted in the sister. There was also a record of a blood cousin of the patient who is the son of a brother of the patient's mother; he was reported as having anemia and splenomegaly.

The patient had had the usual childhood illnesses. There were no other medical illnesses noted. He had had a tonsillectomy in childhood. There were no other operations noted and venereal disease was denied.

Examination revealed a fairly well developed, nourished white male, who was ambulatory. There was a mild icteric tinge to the sclerae and conjunctivae. A moderate degree of pitting scars were found on his face, back and neck due to acne vulgaris. Blood pressure was 114/76. The head, neck, chest and heart borders were normal. There were no thrills, murmurs or arrhythmia. On inspection a distinct bulging was noted in the left upper quadrant. The spleen was very definitely enlarged so that the lower border of the spleen was felt

at a level of about four fingerbreadths below the costal margin and was at the level of the umbilicus. The liver and kidneys were not made out. There were no other masses demontrable in the abdomen and no tenderness or rigidity. The genitourinary, musculoskeletal and neuropsychiatric systems were essentially normal.

Preoperatively, on March 9, 1945, the red blood count was 3,900,000; white blood count 5,900; hemoglobin 77 per cent, platelets 312,000; differential—polymorphonuclears 46 (4 staffs); lymphocytes 46; monocytes 2; eosinophiles 1, reticulocytes 1.2 per cent. On March 15, 1945, the red blood count was 4,190,000; white blood count 1,207; differential—polymorphonuclears 76 (3 staffs); lymphocytes 22; monocytes 2, eosinophiles 1; basophiles 1, hemoglobin 77 per cent, sedimentation rate 8. On March 17, 1945, the white blood count was 16,600; polymorphonuclears 78; lymphocytes 21; eosinophiles 3; basophiles 3; reticulocytes 11. (Just prior to the onset of this elevated white count, the patient had a mild upper respiratory infection with some pharyngitis.) There was some poikilocytosis and slight anisocytosis noted in the peripheral blood smear. (Throat smear taken at that time showed some Staphylococci aureus.) The white count taken on March 16, 1945, during the upper respiratory infection showed white blood count 10,007; differential relatively unchanged as of March 17, 1945. *Red blood cell fragility test:* March 19, 1945: Beginning hemolysis .44; complete hemolysis .38. This was preoperative erythrocyte fragility determination. This was repeated on March 16, 1945, and beginning hemolysis was noted as .46 and hemolysis was complete at .36. The normal limits are .44 to .32. *Icteric index:* March 9, 1945: 25. *Van den Bergh's test:* Delayed direct reaction. *Sternal marrow study:* March 17, 1945: Red blood count 4,070,000; nucleated cells 109,800; differential—polymorphonuclears 16.5 plus 17 immature staff cells; lymphocytes 10.8 eosinophiles 2.1; basophiles .1; normoblasts 29; megaloblasts .8; degenerates 3.1; neutrophilic myeloblasts 16.4; eosinophilic myeloblasts .5; hemoglobin 81 per cent. Peroxidase stain showed 79 per cent granular cells, 21 per cent non-granular cells. *Gastric analysis:* Ewald meal—amount obtained 22 cc.; total acid 48 degrees; free acid 25 degrees; combined acid 18 degrees; no blood present. *Urinalysis:* essentially normal. Specific gravity 1028. There was no albumin or sugar. Examination of the urine for urobilinogen disclosed presence of urobilinogen in moderate amount (March 13, 1945). *Liver function test:* Ceph. flocculation—4 plus. Takata Ara—4 plus. Van Den Burgh—negative direct reaction. *Prothrombin time:* A preoperative prothrombin time was requested but due to technical difficulties was not completed. *Stools:* Negative for blood. *Determination of blood type and Rh factor:* Blood type was "o," and he was Rh positive. *Blood smears of the peripheral blood:* Counts of wet smears, showed an occasional (3 per cent) spherocyte; they were very distinctly in the minority, however. There was also a rare spherocyte in the bone marrow study. Studies for presence of hemolysins were not carried out.

Chest plates disclosed the chest to be normal. Diaphragms were smooth. The heart and lungs were within normal limits. Gallbladder visualization disclosed faint visualization of the biliary tract, although the concentration was quite low. The *x*-ray impression was that of a faintly visualized gallbladder but with evidence of a good emptying time, indicating a normal functioning gallbladder. Radiograms of the skull, dorsal vertebrae, hands and pelvis were taken to rule out the possibility of evidence of bone marrow hyperplasia and hypertrophy. There was no evidence of any abnormality of the bony architecture of any of the above structures.

Based on the above data we believed that we were dealing with a case of congenital hemolytic icterus despite some of the atypical findings. Accordingly, splenectomy was recommended and carried out on March 21, 1945. There were no unusual problems at time of surgery and the spleen was seen to be considerably enlarged, weighing 866 Gm. (Table II.)

The specimen was submitted to Dr. Frank R. Menne, Pathologist, University of Oregon Medical School, whose report was as follows:

Gross: Specimen consists of spleen. It is markedly enlarged—weighing 866 Gm. It measures 22.0 by 13.0 by 9 cm. in size. The cut surface is deep reddish purple. The trabeculae are increased in amount. The follicles are uniformly enlarged. They are pinhead in size. Bloody fluid can be scraped from the pulp.

Microscopic Findings: The capsule of the spleen is intact. The pulp is filled with red blood cells to an incredible degree, so that the usual

markings are missed although an occasional follicle can be seen.

Pathological Diagnosis: Splenomegaly due to chronic hemolytic icterus.

COMMENTS

We believe that this case represents another instance of true familial hemolytic icterus with normal red cell fragility. In addition, the presence of very few microspherocytes in the peripheral blood (average 3 per cent) is indeed unusual. In the case reported by Hurley and Moore,[16] the same observation is made. As a matter of fact, they state at no time during the period of observation were they able to observe any microspherocytes. They also observed a normal reticulocyte count. It seems then possible to infer that in our case, the normal fragility here may be related to the paucity of spherocytes which are responsible for its increased fragility. On the other hand, normal fragility has been explained by some on the (Cheney[17] Reynolds[18]), basis that the reticulated red cells are more resistant to hemolysis than a normal red blood *cell.* This hypothesis has not found much support, but it could apply here in view of our findings of relatively high reticulocytosis.

Of additional interest is the unusual hemolytic crisis occurring postoperatively with a drop in blood count to about two and a half million, etc. This is not readily explained and is most unusual, postoperatively. On the other hand, preoperatively, crises have been brought about by blood transfusions and are generally known. This has been emphasized in the literature,[19,20] and it is generally appreciated with preoperative blood transfusions. In congenital hemolytic anemia, it is contraindicated even if the anemia is striking. It may indeed be fatal at this time, viz., preoperatively.

On the other hand, transfusion after the splenic pedicle has been clamped is perfectly safe. It is not often necessary because of the so-called autotransfusion reaction which occurs with splenectomy. It is because of this reaction that splenectomy may be fairly safely undertaken even in very anemic patients.

The phenomenon of the autotransfusion reaction immediately following splenectomy is generally known. Its value as a confirmatory diagnostic measure is acknowledged and generally appreciated in the literature. Similarly, absence of such reaction is highly suggestive of a probable poor result to follow. The phenomenon of autotransfusion has almost been universally observed in typical hemolytic anemia treated by splenectomy.

In the autotransfusion reaction the most significant response is the so-called reticulocyte response to splenectomy as manifested by a very prompt rise of the peripheral blood count. However, along with this reticulocyte response there is also noted a very distinct rise in the white and platelet count as a result of the autotransfusion. It is indeed striking to note that in our patient this reaction began to manifest itself. There was a very distinct rise in the platelet count, in the white count and in the erythrocytes. However, this was not sustained. While the platelet count and the white blood count continued elevated, in about twenty-four hours the red blood count dropped very abruptly. The patient's pulse became very poor, and he appeared to be in shock. There was no evidence of any acute bleeding, however. The reaction probably represents some unexplained type of hemolytic crises, the exact basis of which is not clear at this time. He was given several transfusions, and his red blood count began to rise immediately. His white count and platelet count continued high. In the few days following splenectomy, it was observed that his reticulocyte count began to drop and approach normal and similarly, his icterus began to subside, and within a short time his icteric index was relatively normal.

The indications, advisability and poor results of splenectomy are indeed impor-

tant to bear in mind. True cases of congenital hemolytic anemia give rather uniformly good results. The cases of so-called atypical or acquired congenital hemolytic anemia give uniformly poor results. Thompson finds such poor results in fifteen cases[21] chronic variety are poor risks. After a period of many years, they make a relative adjustment to their disease. In any event, they may be benefited by liver extract and can be carried along quite comfortably. The mother of our patient

TABLE II

TABLE OF PRE- AND POSTOPERATIVE LABORATORY DATA

Date	RBC in Millions	WBC	Platelet Count	Reticulocytes, Per Cent	Hemoglobin, Per Cent	Remarks and Other Data
Pre-op	3.91	5,900	.....	12	77	Takata Ara 4+
3/9/45						Van Den Berg neg.
3/17/45	....	16,600	.....	11.7	..	Ceph. Chol. Flocc 4+
						Sed. Rate 8
3/20/45	3.8	8,400	.....	12	76	RBC Fragility
						Begins .44, ends .38
Operation	3.47	10,500	309,000	14.3	81	Icterus 25
3/21/45						Urobilog. urine +
3/21/45	3.1	11,600	311,000	14.5	81	RBC Fragility
25 min. p.o.						Begins .46, ends .36
3/21/45	3.2	9,400	315,000	15.2	81	
25 min. p.o.						
3/21/45	3.1	17,200	331,000	15.1	69	
2 hrs. p.o.						
3/21/45	4.7	26,300	190,000	14.5	78	
5 hrs. p.o.						
3/22/45	3.3	39,000	376,000	14.5	57	
24 hrs. p.o.						
3/22/45	3.25	28,500	.....	....	55	
36 hrs. p.o.						
3/23/45	2.37	31,000	298,000	15.5	..	RBC Fragility
48 hrs. p.o.						Begins .46, ends .32
3/24/45	2.48	15,400	.....	....	47	
3/25/45	3.5	16,000	.....	....	62	
3/26/45	3.05	18,500	.....	....	61	Icterus 30
3/29/45	3.89	16,500	.....	....	78	
3/31/45	4.88	21,200	.....	....	88	
4/2/45	4.2	11,100	.....	1.7	84	Ceph. Chol. Flocc 2+
4/3/45	4.12	14,100	.....	....	83	Icterus 20
4/5/45	4.5	14,200	76,000?	....	80	
4/7/45	4.1	.....	.....	....	80	
4/9/45	4.1	13,400	.....	....	80	
4/12/45	....	.....	.....	0.8	..	Icterus 7
4/13/45	3.9	8,200	210,000	0.5	78	RBC Fragility
						Begins .42, ends .36
5/2/45	4.3	12,200	120,000	....	81	Icterus 9
						Ceph. Chol. Floc. neg.
5/31/45	4.5	15,500	288,000	1.0	81	Icterus 7

out of forty-five reported cases. Freund[22] has reported poor results from splenectomy in children, one with probable congenital and the other, acquired hemolytic jaundice. Ordinarily, the best results have been obtained in younger people. On the other hand, older people with a more falls in this category and is presently being treated with liver extract. Although her peripheral blood count is down she feels fair. The advisability of splenectomy has been considered in her case and has been rejected at this time because of the above factors.

While splenectomy ordinarily effects a very striking and dramatic cure in most cases of true so-called congenital hemolytic icterus, failures have been recorded. Several reasons have been advanced. First, some hemolymph tissue or accessory spleen may have been overlooked at the time of surgery. The importance of an accessory spleen has been emphasized by Curtis and White[23] who report its presence in 10 per cent of autopsy material studied and in 20 per cent of their cases in congenital hemolytic jaundice coming to operation. In each patient they report the accessory spleen was found in or took its attachment from the principle pedicle of the spleen. Second, another possible explanation for failure of splenectomy is the presence of so-called hemolymph tissue. Hemolymph structures, such as the abdominal hemolymph nodes, undergo striking hypertrophy and assume hemolytic characteristics. An example of this is the case reported by McLaughlin.[24] Third, one must remember that there may be a wrong diagnosis and that one may not be dealing with a true congenital hemolytic icterus, but rather with an acquired variety which does not ordinarily respond to splenectomy. Fourth, the possibility of hemolysins playing a rôle and producing continued hemolytic effect should also be borne in mind.

An interesting observation here is the presence of unexplained liver damage which rapidly improved following splenectomy. (Table II.)

One last feature of significance of congenital hemolytic icterus is the presence of gallbladder disease in about 70 per cent of the patients. This is due to the formation of stones which are formed by the broken down hemoglobin due to episodes of deglobulinization, producing excess bilirubin and bile pigment. Many patients will enter with their primary complaints centered around and referable to the gallbladder. Our patient had no complaint referable to the gallbladder, and at time of laparotomy, examination of the gallbladder revealed it to be essentially normal.

SUMMARY

1. Study of a case of congenital hemolytic icterus cured by splenectomy with the following unusual features is reported: (1) Normal red blood cell fragility; (2) minimal microspherulosis; (3) the presence of liver damage improved by splenectomy; and (4) the occurrence of an unusual postoperative hemolytic crisis.

2. The hypotheses on etiology are reviewed.

3. The effects of splenectomy and the reasons for failure in certain instances are considered.

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INTERSTITIAL HERNIA

REVIEW OF THE LITERATURE AND REPORT OF THREE CASES

ARTHUR M. DICKINSON, M.D.
Associate Professor of Surgery, Albany Medical College
ALBANY, NEW YORK

IN the nomenclature of ventral abdominal hernia, a great deal of confusion exists. It will clarify our present discussion if at the onset, we define interstitial hernia. It is a form of an indirect (oblique) inguinal hernia which emerges from the abdomen through the internal abdominal ring but does not descend through the inguinal canal. Instead the sac spreads out between the layers of the anterior abdominal wall.

The hernia sac may be located between any of the layers of the abdominal wall but most commonly it is found between the internal oblique and the aponeurosis of the external oblique. Lower and Hicken[1] call these hernias "interparietal" instead of "interstitial." Based upon the location of the sac they classify the varieties as follows: (1) Properitoneal hernia in which the sac lies anterior to the peritoneum but deep to the transversalis fascia, (2) interstitial hernia in which the sac is located between the transversalis fascia but beneath the external oblique, and (3) superficial hernia in which the sac is superficial to the external oblique. From an anatomic basis, this classification is splendid but the commonly accepted term is "interstitial hernia."

In these hernias, the direction taken by the sac is also variable. The sac may pass upward well above its point of emergence from the abdomen; it may extend laterally in the direction of the location of the anterior superior iliac spine; it may be displaced medially in a variable relationship to the rectus muscle. The location of the sac will obviously depend upon the site of the congenital or acquired weakness of one of more structures that go to make up the abdominal wall. Very frequently the sac is bilobed and occasionally there are three lobes. Commonly the most proximal of these sacs is located at the level of the peritoneum while the other and usually the larger one extends out between the layers of the abdominal wall. Here we should note the similarity to the two-legged sac so frequently encountered in the common type of indirect inguinal hernia, in which the second sac is of the direct type and is often missed at operation resulting in so-called recurrence.

The contents of the sac vary. Omentum is a frequent occupant. Small or large bowel are also commonly found. Sometimes the hernia is of the sliding type. Often the bladder may occupy the sac either as a partial prolapse or as an actual diverticulum. The sac may contain nothing but fluid. Holmes[2] reports a case of properitoneal hydrocele which was trilocular, two of the sacs being located in the scrotum and the third within the abdomen. It is most uncommon for other viscera such as the pelvic organs to migrate into the sac.

Interstitial hernias are more common in males and are quite frequently associated with some form of mal-descent of the testicle which emphasizes the importance of the congenital factor again. However, there are reported a fair number of such hernias in females.

The symptoms of interstitial hernia are often very confusing. Frequently the diagnosis is not made until the patient comes to surgery; occasionally it is missed even at operation and only determined at autopsy. Obviously the size of the hernia sac, its contents, the presence or absence of strangulation, etc., are factors which alter

the symptoms. Many patients complain only of pain or discomfort in the lower abdomen. This is usually relieved when the patient goes to bed and gradually increases as he is up and about. They may describe it as a dragging sensation that they are not able to localize accurately. Usually the physical examination is not particularly revealing especially if the person has a thick abdominal wall. This type of individual often goes from one physician to another and the true diagnosis is not recognized until exploratory operation is done. Obviously if a thorough exploration of the abdomen is made, the hernia emerging through the anterior abdominal wall should be recognized. Many operators, however, explore only within the abdomen and overlook the anterior abdominal wall. It is always wise, when the abdomen is opened for any cause other than peritonitis, to explore the internal openings of inguinal and femoral regions digitally. Also, the relative thickness of the abdominal wall on both sides of the incision should be compared. In one of the cases reported below, the diagnosis was made at operation by noting increased thickening of the abdominal wall on one side of the incision.

Other patients consult the surgeon because of a mass in the lower abdomen. Often they have discovered it themselves and desire advice. These persons may tell you that the mass seems to get smaller when they go to bed and larger when they are up. Upon examining these individuals the mass may be easily felt at times although in some cases it seems to disappear during examination and thus leaves an element of uncertainty in the mind of the examiner. The mass will vary in size and consistency and its location is often indefinite. Different examiners may be inclined to believe that the mass occupies entirely different levels. In one of the cases reported below, the author was of the opinion that it was related to the kidney; his resident was sure that it was ovarian in origin. References to similar confusion abound in the cases reported in the literature. Some patients were studied for renal tumor and had complete urological work-ups. In a case reported by Gray and Horwitz[3] the mass was thought to be a large gallbladder. It was only when *x*-ray films were made of the intestinal tract and loops of gut were seen apparently outside of the abdominal wall, that the true diagnosis was realized. Finally, after having eliminated most of the common causes of abdominal tumor, we may be tempted to consider it as a true tumor of the abdominal wall such as a desmoid, a hematoma or abscess.

A fairly large group of these patients present quite typical symptoms of acute mechanical intestinal obstruction. The only preoperative diagnosis is that of obstruction with cause unknown. Obviously in the presence of advanced obstruction with large dilated coils of gut hampering exploration, the diagnosis may be overlooked and be determined only at the postmortem table.

If a portion of the bladder occupies the sac, the symptoms often point to the urinary tract and this is studied completely before surgery is resorted to. The picture may be further confused in patients who in addition to an interstitial hernia do have some lesion of the urinary tract. White[4] reports a case of traumatic hernia of the bladder with an interstitial hernia.

Occasionally an interstitial hernia is associated with the usual type of hernia and is not discovered until repair of the inguinal hernia is undertaken. Beigler[5] reports such an interesting finding.

From the above mentioned symptoms, it is obvious that the diagnosis of this condition may be very difficult. Repeated examinations in the decubitus and erect positions are helpful. Pelvic and rectal examinations may eliminate a tumor of the pelvic viscera. In some instances intravenous pyelograms or a complete urological study may be required. Perhaps *x*-ray studies of the intestinal tract may seem indicated. Naturally, such procedures are reserved for the patient who is not

acutely ill. In the obstructed group of patients, probably the only justified procedure is a flat plate of the abdomen which may be very informative.

As implied, the condition of interstitial hernia may be a serious one especially in the group of patients who present an acute obstruction. The difficulty of diagnosis and the seriousness of some of the complications combine to make this condition responsible for a rather high death rate.

The treatment is obviously operative. Often the initial incision is of the exploratory type in the lower mid-line. This does not lend itself to repair of a laterally located hernia; however, in some cases by retraction of the overlying layers, the hernia may be exposed and a satisfactory repair accomplished. More commonly, a better repair can be done if the primary incision is closed and the region of the hernia exposed through a conventional incision. If the hernia mass is reducible from within the abdomen, in a few cases a repair can be done from within entirely. Most of these hernias are difficult of repair and it seems wise to have adequate exposure. We have followed the modified Halsted procedure for we believe that it offers the best chance of permanent cure. If a bladder diverticulum is found in the sac, it may be wise to resect it in addition to repairing the hernia. Careful search should always be made for more than one sac in view of the common finding of a double sac.

CASE REPORTS

Case I. M. P., a female, age sixty-one, was first seen August 26, 1944. She was complaining of a swelling in the left lower quadrant with pains in that location on and off for some four or five years. During the past few months the pain had increased. There was no disturbance of bowel habit. There was a history of frequency and burning on urination for several weeks. The remainder of the history seemed irrelevant. Upon physical examination a soft tumor mass, the size of an orange, was felt in the lower left quadrant; it seemed to be fixed to the anterior abdominal wall; there was a suggestion of an impulse on coughing. Pelvic examination was negative except for a relaxed pelvic floor. Because of the history of urinary tract disturbance, an intravenous pyelogram was done with essentially negative findings. The routine study of urine and blood were negative. A few days after admission to the hospital, the mass was explored through a left rectus incision. A single hernia sac about the size of a small orange was found anterior to the aponeurosis of the external oblique through which it emerged at a site immediately over the internal abdominal ring. The sac contained adherent omentum. After incision of the sac the contents were reduced. The aponeurosis of the external oblique was then split upward and downward to secure the usual exposure of the floor of the inguinal canal. The sac was dissected well and was transfixed and ligated at its neck. A Halsted type of repair was then done utilizing black silk throughout. The patient made an uneventful postoperative recovery and recent check-up reveals no apparent weakness at the site.

Case II. A female, age sixty-four, was first seen on March 7, 1944, at which time she was complaining of pains in her lower abdomen which had existed for about seven months. At times the patient thought there was a "bunch" in right lower part of the abdomen. During this period, there had been a tendency toward constipation and the patient had found it necessary to resort to cathartics which was unusual. Also there had been a loss of ten pounds during this period. In addition there was some frequency of urination. Examination of this patient revealed a slightly tender, moderately movable mass in the right lower quadrant. No impulse on coughing was detected. Blood examination showed a moderate secondary anemia and a sedimentation rate of 16 (Wintrobe). The impression at this time was that the condition was probably a tumor of the cecum. Accordingly, a barium enema study was done with no significant findings. Four days after admission the mass was explored through a right paramedian incision. As the aponeurosis of the external oblique was exposed, a bulging was noted in the region of the inguinal canal. The skin incision was carried lateral so that by retraction the inguinal area was uncovered. The aponeurosis of the external oblique was then split upward from the external ring along the line of the inguinal

canal. This revealed a hernia sac, the size of a hen's egg, which emerged through the internal ring and spread medially and upward to the plane between the posterior rectus sheath and the rectus muscle. The sac contained omentum which was easily reduced after incision. The sac was dissected out and after search for another lobe, the sac was ligated high up, the distal portion being removed. The canal was then closed by the Halsted method using black silk. The patient made a satisfactory postoperative recovery. Recent examination reveals no recurrence.

Case III. C. M., a female, age sixty-eight, was first seen October 10, 1945. She was complaining of a "bunch" in the left upper quadrant for three years. It had gradually increased in size and lately caused some pain. The patient stated that the mass seemed to move; sometimes it appeared to be just underneath the ribs and at other times it was below the level of the navel. Associated with this complaint was the story of considerable gas and increasing constipation. Physical examination revealed a rather firm mass, about the size of a grapefruit in the left half of the abdomen at the level of the umbilicus. The mass was moderately fixed and no impulse on coughing was detected. Pelvic examination was not satisfactory but the mass could not be felt. A scout plate of the abdomen was negative. It was believed that the mass was probably an ovarian tumor. Exploration through a mid-line suprapubic incision was carried out. Upon entering the abdominal cavity, much to our amazement, we found no tumor. Examination of the left side of the abdominal wall revealed marked thickening and palpation of the region of the internal abdominal ring disclosed a hernia mass entering it. The abdominal incision was enlarged and retracted to expose the left inguinal region. The usual exposure through the external oblique was done. A large sized, single hernia sac containing a sliding hernia of the sigmoid was found. The sac had spread out between the two obliques, above and lateral to the internal ring. The sac was trimmed as close to the sigmoid as possible and then closed with a running suture. The inguinal canal was repaired with black silk after the Halsted technic. This patient has recently been examined and at present, no recurrence seems to exist.

CONCLUSIONS

1. The literature on interstitial hernia has been reviewed and the problem discussed.
2. Three additional cases are reported.
3. The difficulty of diagnosis is stressed.
4. The importance of the finding at operation of an increased thickening of one side of the incision is noted.
5. The need for careful examination of the posterior surface of the anterior abdominal wall during exploratory operations is emphasized.

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INCIPIENT EPIPHYSEOLISTHESIS OF THE HIP*

ITS DIAGNOSIS AND TREATMENT

SAMUEL KLEINBERG, M.D.
Chief of Orthopedic Surgery, Israel Zion Hospital
NEW YORK, NEW YORK

ALL of us are confronted with cases of disabling arthritis of the hip joint in adults traceable to an epiphyseolisthesis in adolescence. There is a variable but persistent disability, pain and a limp which, appearing insidiously in the third or fourth decade, increase in intensity, disturb the function of the limb and interfere with the normal activities of the individual. On close questioning, one elicits the fact that the patient had for many years been aware of occasional stiffness of the hip and lack of complete freedom in locomotion, but was so accustomed to these conditions that he paid little attention to them. It is only when the locomotor discomfort and disability become marked that the individual is compelled to take note of them. The symptoms are the result of a permanent structural damage to the head of the femur characterized by an enlargement and deformity of the femoral head, irregularity of its articular contour and surface and, not infrequently, a partial luxation. The disability may become severe enough to require major surgery such as a transpositional osteotomy, an arthroplasty or an arthrodesis to ameliorate the symptoms. In no such instance can a normally functioning hip and limb be obtained.

When one contemplates this situation one realizes that the dysfunction of the hip and its attendant symptoms are the result of inadequate treatment during adolescence. If we could prevent the slipping and the consequent deformation of the femoral head during the early phase of the ailment, an arthritis of the hip, otherwise an inevitable sequel of weight bearing, might not ensue at a later date. I am under the strong impression, based so far on an experience with only a comparatively small although representative group of cases, that, if epiphysolisthesis is recognized in its incipiency and the epiphyseal plate surgically obliterated, the head and neck of the femur would fuse, displacement and deformity of the head would be prevented, a normal blood supply to the head would be maintained through the cervical vessels, an arthritis from disturbed mechanics in the hip would be prevented and normal or practically normal function would be retained in the hip and limb.

The first step in the therapeusis of epiphyseolisthesis, and manifestly the most important one, is the recognition of this lesion in its incipiency. A practical classification of the different stages or types of epiphyseolisthesis, based on the gross pathology and the therapeutic possibilities, is the following: (1) Incipient stage, (2) stage of moderate slipping, (3) stage of severe slipping, and (4) acute slipping.

Each of these types requires a different method of treatment, a treatment designed to correct or to improve a specific pathological condition. The results in types 1 and 4 can be a normal or *nearly* normal hip joint; the final outcome in the management of types 2 and 3 is always uncertain and never a normal hip.

Etiology. I shall omit any extensive comments on the etiology of epiphyseolisthesis because, in a word, no one has as yet been able to identify and establish unequivocally the exact cause or causes. There has been speculation about the influence of an endocrine disturbance, particularly in youths of the Fröhlich

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type with overgrowth of the adipose tissue and underdevelopment of the sex glands. This condition, if of importance in some cases, is manifestly not a factor in many others who give the appearance of normal anatomical and physiological development. A disturbed circulation in the femoral head and neck has been assumed to be the underlying basis in other cases, but no definite or consistent pathological state has been found to permit a logical explanation on this score. From time to time other causes have been proposed, but none have been substantiated or stood the test of time.

In the present study I shall confine myself to a consideration of only mild or incipient epiphyseolisthesis. It is my conviction that if at this stage of the malady treatment is applied which will eliminate the epiphyseal plate and cause the femoral head and neck to fuse, the pathological process will be arrested and a normal or nearly normal hip joint will be assured. It is of paramount importance, however, that the lesion be recognized before much slipping has occurred, because after substantial slipping has taken place, the results, except in the comparatively uncommon instances of acute slipping (group 4 in my classification), are anatomically and functionally uniformly poor.

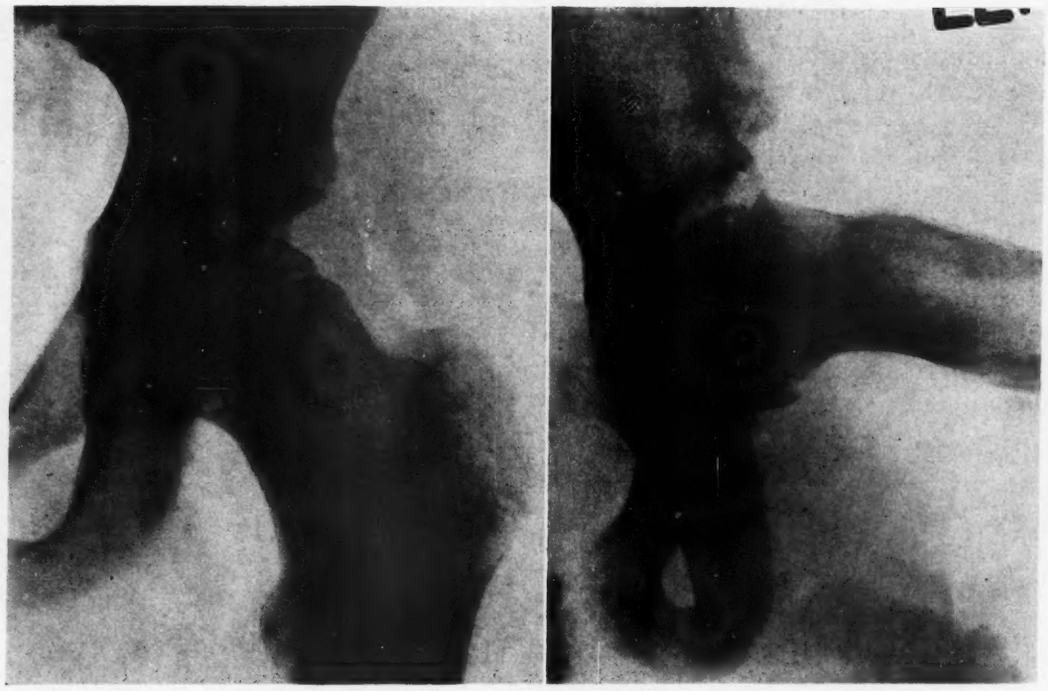
Pathology. The morphological changes are best visualized in roentgenograms of the hip including anteroposterior and lateral views. The capital epiphysis or head has slipped downward, backward and inward on the neck but remains intimately attached to it. Normally, the head projects a little beyond the superior border of the neck forming a sort of "shoulder." This projection is reduced or obliterated. Depending on the degree of backward slipping the head may appear only slightly reduced in its vertical diameter or may be crescentic in shape instead of hemispherical. In the lateral view one may more readily see the downward displacement through projection of the head beyond the neck. The texture of the head is unaltered and the articular surface is smooth and unbroken.

FIG. 1. Note absence of "shoulder" at upper border of head and neck. There is widening and irregularity of epiphyseal plate and juxta-epiphyseal rarefaction and sclerosis in neck.

The epiphyseal plate is thickened and irregular. Instead of being $\frac{1}{16}$ to $\frac{1}{8}$ of an inch in its vertical diameter, it may be $\frac{1}{4}$ of an inch thick and irregular in consistency.

The neck appears shortened and widened because of a relative anteversion. Directly beneath the epiphyseal plate there are usually several areas of rarefaction and sometimes some streaks of sclerosis are present. Elsewhere the neck has a uniform texture.

The head and neck are always in intimate contact but their relationship has been altered. All of the above mentioned changes are not always present or at least evident. They may all be seen in an anteroposterior view, or some may be visible in an anteroposterior film and others in the lateral roentgenogram. It is therefore imperative that the hip be viewed in different planes. (Figs. 1, 2 and 3.)



A B

FIG. 2. A, loss of shoulder. The head is crescentic with widening of the neck and irregularity of the epiphyseal plate. B, lateral view of same hip. Slipping is evident and the epiphyseal plate is irregular.

Epiphyseolisthesis of the hip indicates a slipping of the head of the femur on the neck of the femur exactly as a spondylolisthesis denotes a slipping of one vertebra on another. The basic lesion is in the epiphyseal plate. There is a metabolic and structural derangement in it which results in a weakening of the bond between the head and neck. The actual slipping is probably initiated by multiple minor traumas incidental to weight bearing enhanced in some cases by overweight. Once the slipping has begun it is likely to progress gradually or it may increase suddenly until the head is markedly displaced and the proximal surface of the neck is in contact with the anterior and upper portion of the acetabulum. In an undetermined percentage the slipping may remain mild even without treatment. The lesion being entirely within the capsule of the hip joint there ensues a congestion and ultimately an hypertrophy of the synovia as an expression of the irritation of the joint and nature's attempt at repair. The reparative process leads in the more advanced cases to the formation of a pannus of synovia and to new bone deposit at the inferior junction of the head and neck, in an effort to arrest the slipping.

Symptomatology. From the above described pathology one can readily surmise the clinical course and the symptoms. A boy or girl, usually ten to thirteen years of age, after some minor injury, or just as often without any apparent trauma, experiences mild pain in the hip, thigh or knee and begins to limp. The limp may precede the pain. Neither symptom is severe at first and is rapidly relieved by rest. Both symptoms, intermittent at first, become more pronounced and persistent. The objective evidence of hip joint irritation is unequivocal. The patient walks with a limp. The affected limb is held in an attitude of outward rotation. Extension and outward rotation at the hip are usually free. Only exceptionally is there a slight flexion contraction. Flexion may be entirely free or moderately limited. Most frequently as the limb is flexed it goes into outward rotation. Inward rota-

A B

FIG. 3. A, film made June 2, 1941. There is marked widening of the epiphyseal plate and shortening of the neck. B, film made on June 3, 1941, when symptoms became acute. Note the marked displacement of head.

tion is very definitely and always restricted. It may be only mildly restricted or may be completely limited. In the very mildest cases the restriction of inward rotation is best appreciated by placing the patient in the prone position with the knees flexed and rolling his legs outward. Abduction is moderately restricted. There may be some sensitiveness to pressure over the front or lateral aspects of the hip. If the lesion has been present for several months, there will be an atrophy of the thigh of ½ to 1 inch. The outstanding clinical features of the affected limb are an attitude of outward rotation and limitation of the movement of inward rotation. The history in an adolescent child of an intermittent limp and the finding of the limb in resistant outward rotation are as characteristic of epiphyseolisthesis as the history of sudden disability in an elderly individual coupled with a painful limb in outward rotation are significant of a fracture of the neck of the femur.

As was previously stated recognition of epiphyseolisthesis in its incipient stage is indispensable for the application of effective treatment. Fortunately, the objective signs, both clinical and roentgenographic, seen in a youth ten to fifteen years of age, particularly in an overgrown fat boy, leave no room for doubt about the diagnosis.

When the diagnosis of incipient epiphysolisthesis has been established treatment should be instituted promptly. There is, to be sure, no such emergency as in the management of an acute appendicitis. But one must not feel that weeks and months can be allowed to slip by for the following reasons: (1) The slipping of the femoral head may increase at any time, without any appreciable provocation, so that the epiphysolisthesis enters into the second stage or stage of moderate slipping when the opportunity for an optimum result is lost. (2) An injury, such as a fall or even a misstep will very likely increase the degree of slipping. (3) So long as the patient is walking and bearing weight on the affected limb not only may the slipping increase but, because of the altered mechanics, the hip is in a constant state of irritation. (4) Continuous irritation of the hip leads to congestion and hypertrophy

Fig. 4. This shows an ordinary drill inserted into the femoral neck and perforating the epiphyseal plate.

of the synovia and to the formation of a pannus of synovia over the margins of the articular cartilage, and consequent intra-articular adhesions and even new bone formation especially at the junction of the lower border of the head with the neck.

While we do not understand the etiological factors in epiphyseolisthesis, we do know that elimination of the epiphyseal plate and the resultant bony fusion of the femoral head and neck not only terminate the whole pathological process but establish a resistance in the hip adequate to meet the normal requirements of motion and weight bearing. The aim of treatment, therefore, is to eliminate the epiphyseal plate at the earliest possible moment when the head and neck are in normal or nearly normal relations. This can be accomplished through any one of several methods such as, drilling, nailing, pegging and hammering for impaction of the head and neck. My choice is drilling because it is the least traumatic and is positive in its effect. Perforation of the epiphyseal plate results in rapid vascularization and absorption of the cartilage and fusion of the femoral head and neck. I shall, therefore, describe only this method of curing an incipient epiphyseolisthesis, and follow this by a recital of some case reports. Incidentally the loss of growth of the length of the femur from the induced absorption of the epiphyseal plate is so slight that it is, for practical purposes, entirely negligible. It goes without saying that drilling of the head and neck of the femur is not a new procedure. It has been used by many for a variety of lesions in the hip. I here only emphasize its particular value in epiphyseolisthesis.

Technic for Drilling of Hip in Incipient Epiphyseolisthesis. The operation is performed preferably under general anesthesia, and always with *x*-ray control. One requires several drills each 5 inches long and $\frac{3}{16}$ to $\frac{4}{16}$ of an inch in diameter. A 5-inch incision is made over the lateral aspect of the thigh beginning at the tip of the greater trochanter and extending downward. The first drill hole is made just below the trochanter. The drill is directed toward the middle of the femoral head the position of which is approximately half way between the anterior superior iliac spine and the symphysis pubis. It is estimated that in the average child of twelve to fifteen years of age the distance between the outer surface of the femur and the center of the head is about $3\frac{3}{4}$ inches. The drill is, therefore, inserted $3\frac{1}{2}$ inches and an *x*-ray film is made. (Fig. 4.) This will show both the position and direction of the drill. Since we wish only to penetrate the epiphyseal plate to establish a communicating tunnel between the neck and the head, the drill need enter the head for only a short distance, say $\frac{1}{4}$ inch beyond the epiphyseal plate. If the drill has been correctly and adequately inserted, one perforation has been made in the epiphyseal plate. Another should be made to facilitate and hasten vascularization, calcification and ossification of the epiphyseal plate. A second drill is, therefore, inserted just above or below the first one depending on its position. The drills are then withdrawn, the wound closed in layers and a long plaster of Paris spica

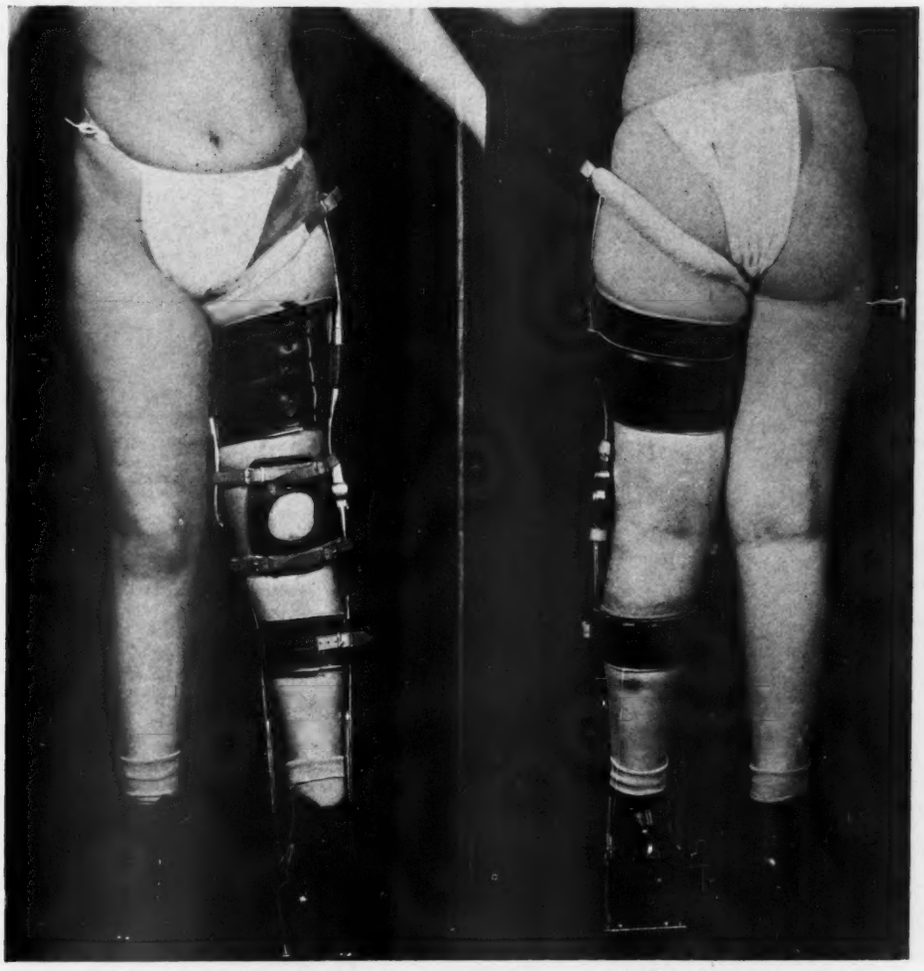


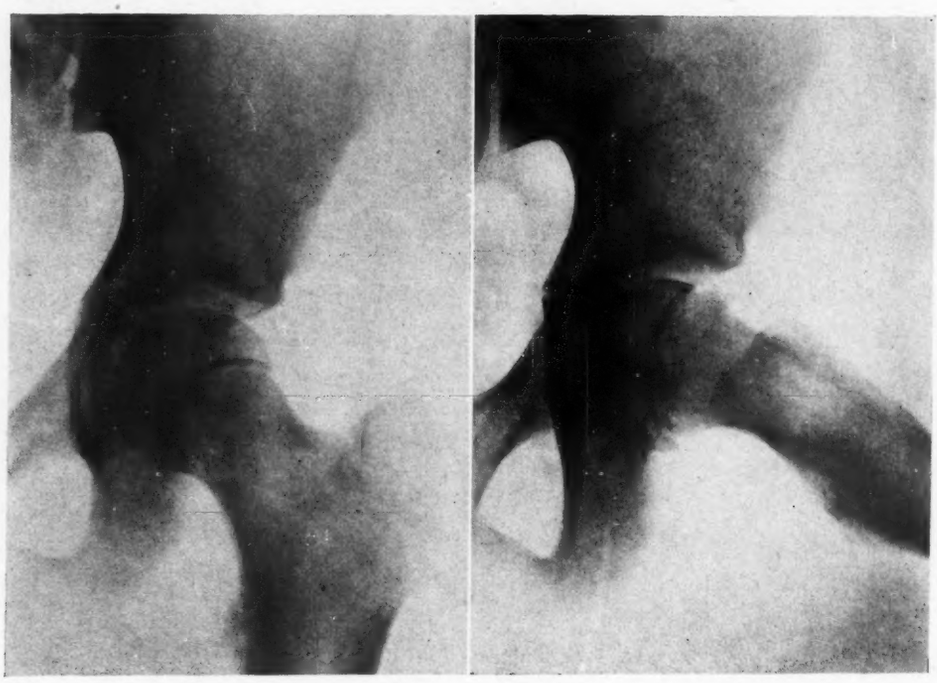
Fig. 5. Photo of a patient with a Thomas knee brace and ischial ring and a high shoe on the opposite foot to assure freedom from weight bearing on the affected hip.

dressing is applied for immobilization of the hip during the healing.

Postoperative Care. The plaster spica is left on for three months during which time the patient is kept in bed and not permitted to bear weight on the operated hip. He is then returned to the hospital, the plaster spica is removed and a new *x*-ray film made of the hip. It will generally be found that the head and neck are in good relation to each other. The epiphyseal plate is thinner than previously indicating a partial absorption. The drill channels are easily visualized. Another plaster of Paris spica is applied extending from the nipple line to at least the middle of the leg. Walking with crutches is now permitted but without weight bearing on the operated limb. Three months later another *x*-ray film is made. This usually shows that the epiphyseal plate is now little more than a line and that the areas of juxta-epiphyseal sclerosis and porosis are becoming nearly normal in texture. The patient is now provided with a brace for support of the hip. (Fig. 5.) One may use a Thomas knee brace with an ischial seat or an ordinary Thomas knee brace extending several inches beyond the foot and provided with traction straps on the shoe, and a high shoe on the opposite side. The brace is worn for six months or a year or longer until there is complete osseous fusion between the head and neck of the femur, and the internal architecture of the head and neck assumes adult characteristics with the bone lamellae extending uninterruptedly from the neck into the head. During this period the hip and knee are mobilized through the use of physical therapy especially voluntary exercise in a

FIG. 6. Case I. K. K. September 26, 1934, shows slipping of the femoral head. The "shoulder" at junction of head and upper border of neck is gone. Epiphyseal plate is irregular and enlarged. The neck is shortened and broadened and has juxtaepiphyseal rarefactions.

FIG. 7. Case I. K. K. November 6, 1935, shows fusion of the head and neck. Epiphyseal plate has disappeared. The articular surface of the head is smooth. Conformation of the head is unchanged.



A B

FIG. 8. Case II. H. B. July 20, 1944. A, anteroposterior view shows only slight reduction of "shoulder." B, lateral view shows irregularity of epiphyseal plate and definite slipping of the femoral head.

warm pool and passive movement of these joints.

ILLUSTRATIVE CASES

CASE I. K. K., a male, fourteen years old, was admitted to my service at the Hospital for Joint Diseases on October 4, 1934, because of a limp on the left side. He was apparently well until one month previously when, without any known trauma and no preceding illness, he began to limp. He also had a mild pain in the left thigh which appeared only after he

walked a considerable distance and disappeared after a brief rest.

The physical examination showed that there was a persistent left limp. Abduction and inward rotation at the hip were mildly restricted. The *x*-ray films (Fig. 6) showed characteristic changes consisting of enlargement and irregularity of the epiphyseal plate, loss of the "shoulder" on the outer extremity of the head, juxta-epiphyseal rarefaction in the neck and shortening and widening of the neck. There was no doubt that he had an epiphyseolisthesis. Drilling was performed on October 5, 1934, and a plaster of Paris spica was applied. The spica was removed on January 18, 1935, the hip *x*-rayed and another spica applied. He was readmitted on April 22, 1935. At this time he had no pain but had some limitation of flexion and inward rotation. He was given a short spica and allowed to walk with crutches but without bearing weight on the operated limb.

Reëxamination in November, 1935, thirteen months after the drilling, showed a complete disappearance of the epiphyseal plate and fusion of the head and neck of the femur. (Fig. 7.)

A letter from the patient in 1945 reported that he was in the Army serving as a physiotherapist and that he had full function of the hip.

Case II. Helene B., ten years old, came under my care in July, 1944. Her chief complaint was pain in the left knee and a limp. The symptoms began two months previously without any antecedent injury or illness.

The examination was negative except for the left hip. Flexion, extension, adduction and outward rotation of the hip were free but abduction was checked at an angle of 45 degrees and inward rotation was moderately but definitely limited. *X*-ray films (8A and B) showed a mild slipping of the capital epiphysis seen particularly well in the lateral view.

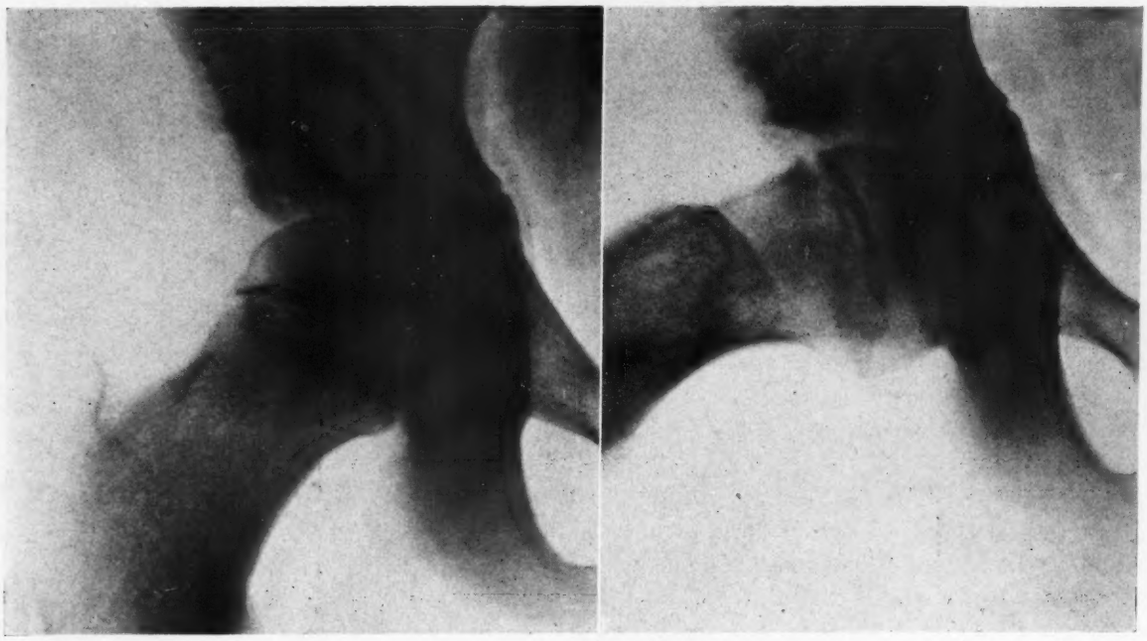
The hip was drilled on July 27, 1944. Three drill channels were made and a plaster spica was applied. On November 7, 1944, a new short plaster spica was applied and the patient was allowed to walk with crutches but without weight bearing on the operated limb. She was readmitted to the hospital on February 5, 1945. Clinical and *x*-ray examinations showed that there had been no further slipping and that the disappearance of the epiphyseal plate was progressing satisfactorily. She was provided with a Thomas knee brace with an ischial crutch and a high shoe on the opposite side. (Fig. 5.)

Fig. 9. Case II. H. B. September 4, 1945. Head and neck are fused. The epiphyseal plate is not visible and the size and shape of the head is normal.

Reëxamination on September 4, 1945, fourteen months postoperatively, showed that the head and neck were completely fused and that the shape and size of the femoral head were normal. (Fig. 9.) Clinically, this patient had a full range of motion in the hip joint.

Case III. Theodore K., fifteen years old, had bilateral epiphyseolisthesis. This boy was admitted to my service on October 19, 1942. His chief complaint was stiffness in his knees and a limp which began two months previously. There was no history of injury. The examination revealed a bilateral epiphyseolisthesis. On the right side (Fig. 10A and B) there was widening and irregularity of the epiphyseal plate and a reduction in the "shoulder" of the capital epiphysis. The lateral view showed a definite slipping. On the left side (11A and B) both the anteroposterior and the lateral films showed the characteristic evidences of slipping of the femoral head on the neck.

He had a drilling of both hips on October 28, 1942. He was given a bilateral plaster of Paris spica which was left on for three months.



A B

C

FIG. 10. Case III. T. K. Right hip. A, October 19, 1942, anteroposterior view shows mild slipping and marked irregularity of the epiphyseal plate. B, October 19, 1942, lateral view shows definite slipping of femoral head. C, February 2, 1944, shows fusion of head and neck. Bone lamellae extend from neck into head; there is no evidence of epiphyseal plate.

Subsequently he had physical therapy but no weight bearing for many months.

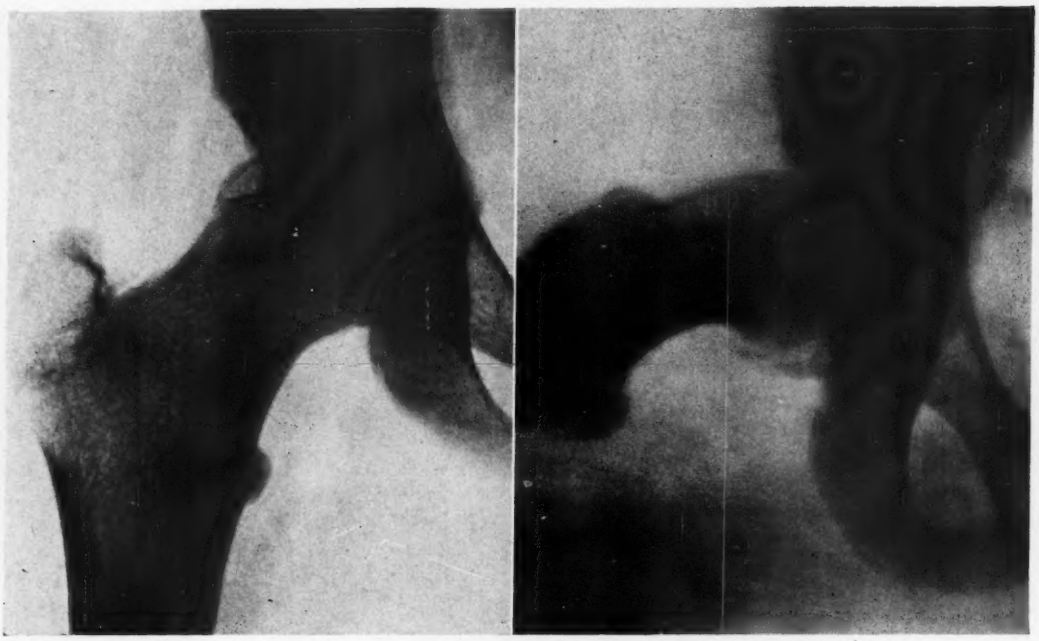
Reëxamination on May 25, 1945, showed that he walked well and without a limp. There was a complete range of motion in the right hip. In the left hip he had slight limitation of inward rotation but free motion in all other directions.

X-ray films made on February 1, 1944 (Figs. 10C and 11C) showed complete fusion of the femoral head and neck in each hip with no loss of substance or distortion of either head.

A B

C

FIG. 11. Case III. T. K. Left hip. A, October 19, 1942, anteroposterior view shows undoubted beginning of slipping of femoral head; the "shoulder" is gone, the epiphyseal plate is irregular, and the upper border of neck is continuous with the articular surface of head. B, October 19, 1942, lateral view shows unquestionable slipping of femoral head. C, February 1, 1944, shows complete fusion of head and neck.



A B

C

FIG. 12. Case IV. N. F. A, November 7, 1937, before drilling. Anteroposterior view shows that femoral head is crescentic. B, November 7, 1937, lateral view shows distinct slipping of the femoral head. C, September 27, 1945, eight years after operation. Head and neck are fused; the articular surface of the head is smooth.

CASE IV. Norma F., twelve and one-half years old, came under my care in November, 1937. Her chief complaint was pain in the right thigh and a limp. She began to favor the limb three months previously. The limp was present only at the beginning of walking but after a few minutes she was able to walk freely and without a limp.

The examination showed that she walked with a limp. At the hip joint inward rotation was limited to 15 degrees. On flexing the thigh on the trunk the limb went into outward rota-

tion. Abduction was checked at 35 degrees. There was no tenderness to pressure over the hip and no shortening, but there was a ½ inch atrophy of the thigh.

The *x*-ray films (Figs. 12A and B) showed in the anteroposterior view that the femoral head was slightly crescentic. The lateral film showed distinct slipping.

She was operated on November 30, 1937. Two drill channels were made. A plaster of Paris spica was applied. Three months later an *x*-ray film showed that the epiphyseal plate was disappearing. Weight bearing was not permitted until the head and neck became fused.

Reëxamination in September, 1945, eight years postoperatively, showed that the head and neck were fused. (Fig. 11C.) The articular surface of the head was smooth. Clinically, she was entirely well with a free range of motion in the hip in all directions.

The experience with the above illustrative cases, and about a dozen others, indicates that the elimination of the epiphyseal plate and fusion of the femoral head and neck can be easily accomplished through a simple drilling of the head and neck. The operation involves a minimum of trauma and does not subject the femoral head to the permanent housing of hardware or to possible damage to its circulation through hammering. There has not elapsed enough time in any of our cases, including even the last one in which the period of observation has been eight years, to permit any dogmatic statements about the end results in adult life. But there is every reason to believe that since fusion of the head and neck occurs rapidly further slipping will not occur. In fact, in none of my cases has there been evidence of any further slipping beyond the slight degree present at the time of the drilling.

We may, I believe, further anticipate that since fusion of the head and neck is established during adolescence deformation of the head and arthritis will not develop during adult life. I, therefore, conclude that the most effective treatment for early adolescent slipping of the femoral head or epiphyseolisthesis, is drilling of the head and neck of the femur with freedom from weight bearing until, usually a matter of one to two years, the epiphyseal plate has disappeared, the head and neck have fused and bone lamellae extend uninterruptedly from the neck into the head.

CARCINOMA OF THE STOMACH*

PERRY B. HUDSON, M.D. AND RICHARD ALT, M.D.
PHILADELPHIA, PENNSYLVANIA

CARCINOMA of the stomach has always been a black chapter in surgery. Both diagnosis and therapy have been inadequate and relatively ineffective. Enormous achievement in other branches of abdominal surgery notwithstanding, the general outlook for a patient who has a malignant tumor arising in the stomach remains desperate and, in most cases, hopeless.

Cases of carcinoma of the stomach are seen initially by practitioners of every branch of medicine and surgery. Most of them, however, are still first seen by men in general medical practice. Even though an extreme effort has been made and much energy expended to educate the medical and lay worlds to the "look and see" rather than the "wait and see" policy for the management of chronic digestive complaints, surgeons even today see relatively few stomach tumors at an early stage. Of course, many more cases are being discovered now than ten years ago. Yet the stage of the disease, in most cases, is approximately the same as in cases diagnosed and treated previously. As a result, our splendid progress in bowel surgery technics were and are little more than futile surgical exercises.

These facts are neither pleasant nor novel. Today they remain as starkly defiant to surgeons and internists alike as they were many years ago. Large clinics may point with justifiable pride to a gradual increase in five-year survivals following gastrectomy, yet it has become increasingly evident that surgery, at its present level of diagnostic accuracy, is not the answer to carcinoma of the stomach as a disease entity.

Our purpose is to present carcinoma of the stomach as it is seen in a modern 200-bed community hospital. Because our experience in treating these tumors has been grossly disappointing, certain quite natural mental reactions to the dilemma have repeatedly been noted. Why, for instance, does the general medical practitioner consistently send in cases after they are hopeless from the standpoint of surgical cure? Why are more cases not referred? Why are earlier roentgenological diagnoses not made? Have changes in surgical technic helped? Have laboratory diagnostic aids become more accurate? Is there any correlation between symptoms and types of tumors or their locations? The number and character of these questions which surgeons ask themselves are legion. Our own approach to the problem is simple. We shall, in this paper, attempt an analytical study of all of the cases of carcinoma of the stomach which were admitted and positively diagnosed, between the years 1917 and 1945. A total of 123 cases of "carcinoma of the stomach" were admitted. However, as is usually the situation, quite a number of the diagnoses are not proved beyond any question or doubt. Therefore, only the cases established by one or more of the following criteria will be studied here: (1) autopsy, (2) biopsy, and (3) operation. Even though the Beverly Hospital annually maintains a high necropsy and autopsy rate, we are able to present only sixty cases for detailed consideration. The cases have, in some instances, been divided into two sections for scrutiny and study regarding progress on changes in diagnosis, treatment and results. Thirty-one cases from the 1917 to 1937 period and twenty-nine cases since 1938 will be analyzed. (Table 1.)

* From the Department of Surgery, Beverly Hospital, Beverly, Mass.

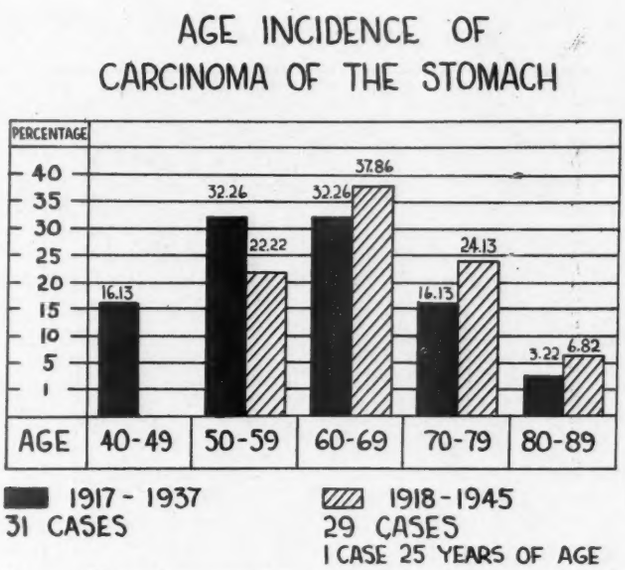


FIG. 1. Chart demonstrating age distribution; no essential change from the old to the newer group of cases.

No attempt will be made to review or summarize the tremendous fund of excellent articles on this subject to be found in medical literature. An attempt will be made to offer pointed suggestions for the ultimate solution of this problem which has rested heavily upon the conscience of those to whom has fallen the responsibility of treating neoplastic disease.

TABLE I

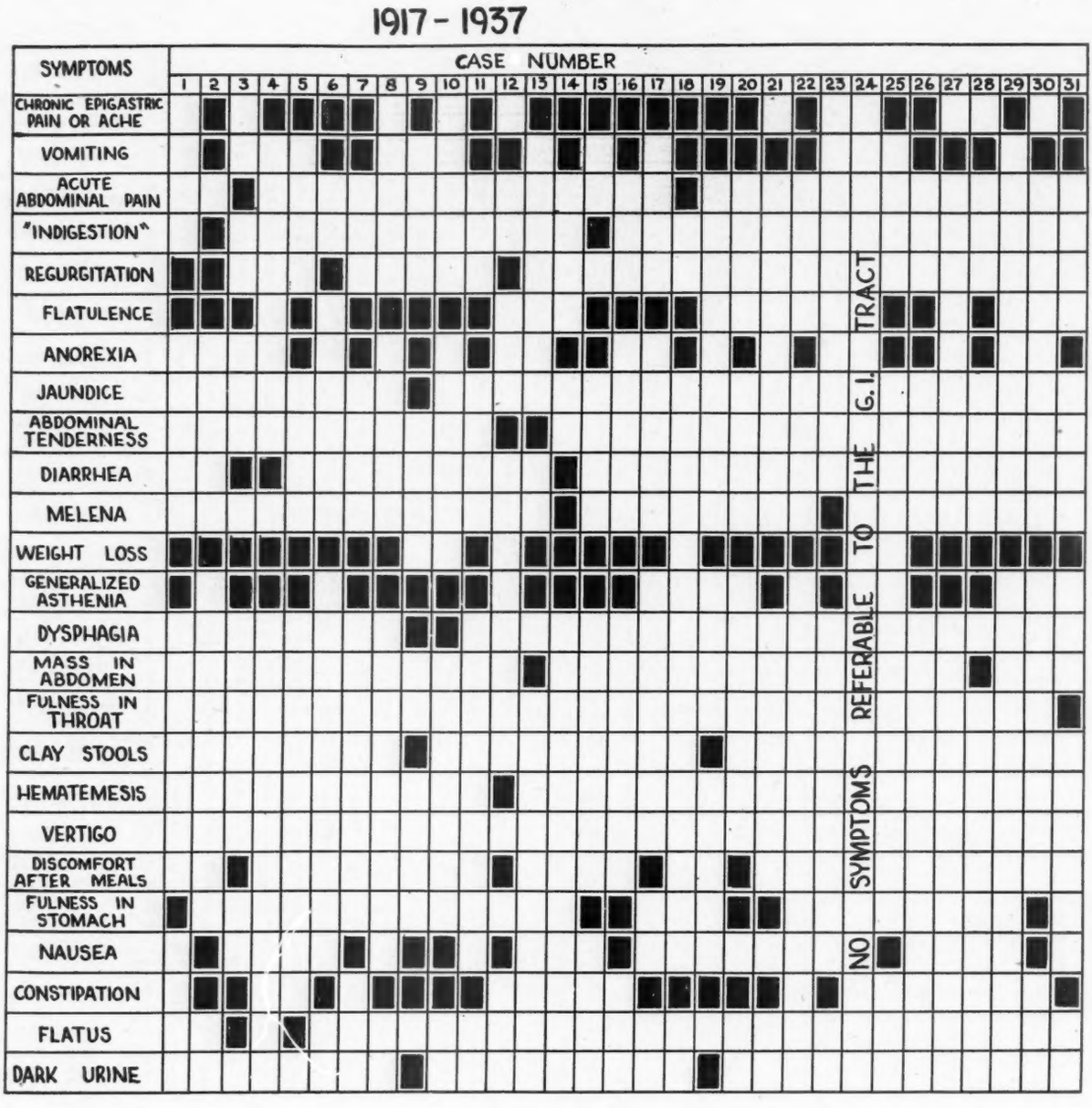
Total number of patients with Cancer of the Stomach from 1917 through 1937	70
Number of cases meeting one or more of criteria for analysis	31
Total number of patients with Cancer of the Stomach from 1937 to 1945	53
Number of cases meeting one or more of criteria	29
Total cases 1917 to 1945	123
Total cases analyzed 1917 to 1945	60

Age. The average age of patients studied from 1917 to 1937 was 60.1, whereas the 1937 to 1945 series yielded an average of 58.6 years. (Table II.) This is an approximate agreement with the general opinion that carcinoma of the stomach occurs most frequently at the age of fifty-five. The youngest patient of the entire study was twenty-five, the oldest eighty-eight. Most of the carcinomas occurred during the fifth and sixth decades of life; there were none during the third. (Fig. 1.) The more recent series of cases gave practically no decrease in the average age of our patients, even though a more intensive effort has been made to drive this disease into the open. This is not remarkable when one considers that: (1) Our diagnostic technics have changed but little; (2) symptoms occur late in the development and spread of the tumor; and (3) the disease kills rapidly and is, therefore, probably not present as such to be diagnosed until a few months at most before the time at which it becomes inoperable or incurable.

TABLE II
AGE INCIDENCE OF CARCINOMA OF THE STOMACH

Age in Years	1917 to 1937 No. of Cases	1938 to 1945 No. of Cases
20–40	0	1
40–49	5	0
50–59	10	6
60–69	10	10
70–79	5	7
80–89	1	2
Average Age	60.1	58.6
Youngest	44	25
Oldest	88	86

Sex. The sex incidence of carcinoma of the stomach has long been known. The predominance of males has been accepted, though as shown in our series (Table III) and in studies by others, the ratio is not



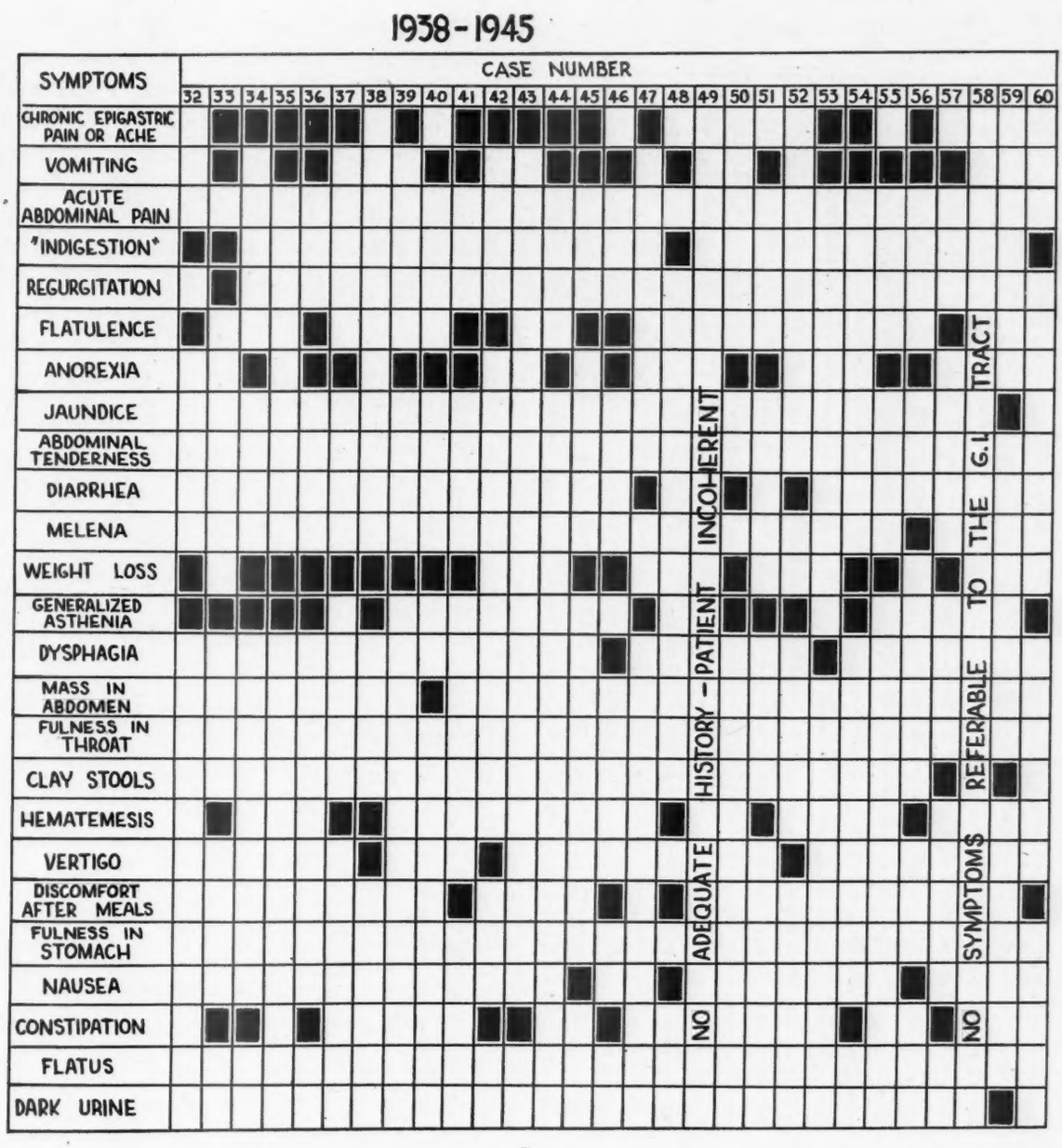
A

FIG. 2. A, this chart reveals the typical varieties of syndromes to be found (in older group).

high enough to treat lightly a symptom complex which suggests the necessity for a full differential diagnosis in either sex. Mortality and morbidity as well as histopathology apparently do not differ by reason of sex alone.

Symptomatology. The symptom complex in this disease is fairly well defined and generally known. There is almost invariably a digestive complaint of some sort. In only 3.3 per cent of the cases there was no complaint even remotely referable to the gastrointestinal tract. However, the single symptom which finally brought the patient to a physician varies considerably.

Chronic epigastric pain or ache was present as the specific chief complaint of 25 per cent of the patients. Another 18 per cent complained primarily of vomiting. Acute abdominal pain represented 8.3 per cent of the cases as the patient's most prominent symptom. The remainder of the patients revealed quite a varied assortment of primary discomforts and unusual



B

FIG. 2. B, same as Fig. 2A except that these syndromes are from the newer group of cases.

happenings. (Table IV.) The combination of symptoms is frequently helpful, whereas the single most prominent symptom may not be at all. (Fig. 2 A and B.)

Duration of Symptoms. There were seventeen cases, or 28 per cent of the total number, in which symptoms of any sort did not develop until within one month of the time a physician was consulted. The average duration of symptoms before seeking medical care was 2.8 months, the older group of cases averaging 3.14 months and those during the 1938 to 1945 period averaging 2.45 months. This would seem, at first glance, to be a reasonably short period during which the patient practiced self-medication or merely made up his mind to see a physician.

Another interesting phase of this subject is the length of time patients were treated before the physician advised either *x*-ray studies, hospitalization or both. The longest period of empirical treatment was two years, which is obviously too long to

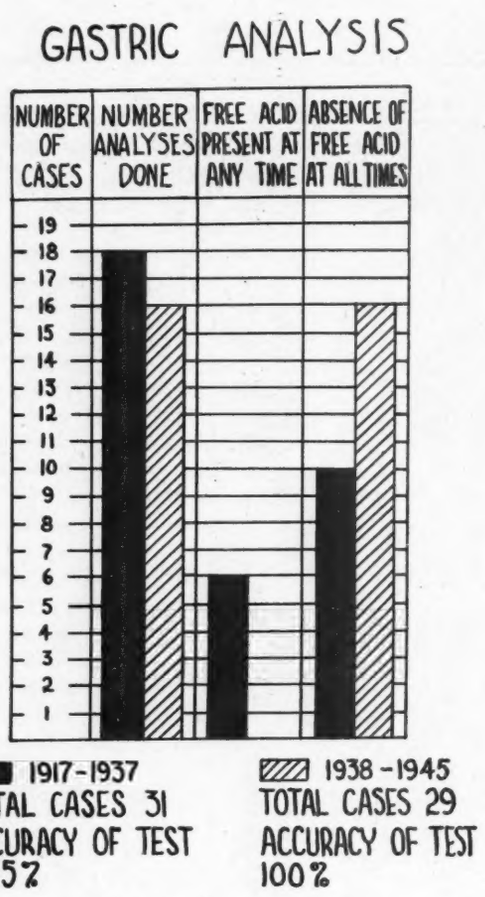


FIG. 3. Reveals increasing accuracy and importance of gastric analysis.

continue an unsuccessful regimen of therapy without seeking roentgenological evidence of a tumor. However, on the credit side of the ledger, 36 per cent of all patients seen by physicians were treated less than a month before hospitalization or *x*-ray study was advised; in 16 per cent of all cases such advice was given immediately.

TABLE III
SEX INCIDENCE OF CARCINOMA OF THE STOMACH

	1917 to 1937		1938 to 1945		1917 to 1945 Combined	
	No.	Per Cent	No.	Per Cent	No.	Per Cent
Males	20	64.5	16	55.2	36	59.8
Females	11	35.5	13	43.8	24	40.2
Total	31	100.0	29	100.0	60	100.0

On the average, patients were treated only 12.4 weeks on a preliminary or trial basis. Here, again, is found what apparently should be a reasonably short period of treatment by alkali, bowel management, diet and other symptomatic measures. Unfortunately, the nature of this disease is such that physicians are still seeing late cases, not early ones, and are futilely referring such cases for surgical therapy.

TABLE IV
SINGLE MOST PROMINENT SYMPTOM OF PATIENTS SUBSEQUENTLY DIAGNOSED AS CARCINOMA OF STOMACH

	No. of Cases	Per Cent
Chronic upper abdominal pain or ache	15	25.00
Vomiting	11	18.33
Acute abdominal pain	5	8.33
Indigestion	4	6.66
Discomfort following meals	4	6.66
Anorexia	3	5.00
Weight loss	2	3.33
Generalized asthenia	2	3.33
Hematemesis	2	3.33
Vertigo	2	3.33
Simple regurgitation	1	1.66
Flatulence	1	1.66
Jaundice	1	1.66
Diarrhea	1	1.66
Dysphagia	1	1.66
Masses in abdomen	1	1.66
Fullness in throat	1	1.66
Incoherent on admission	1	1.66
No gastrointestinal or abdominal symptoms	2	3.33
Total	60	100.00

Our statistics bear this last fact out completely. The average patient lived for only 8.12 months after the initial appearance of symptoms. This interval increased only 0.55 months from the old to the more recent group of patients. The size of the tumor, described under *Pathology*, is further evidence of the advanced stage at which cases are seen, as is the high rate of metastases.

Physical Examination. It is generally acknowledged that ordinary physical diagnostic methods cannot be applied practically with any modicum of confidence in diagnosing an early carcinoma of the

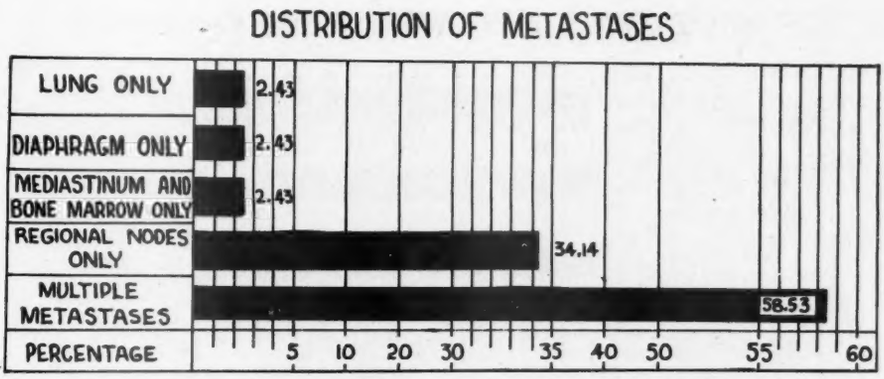


FIG. 4. Showing the extremely high rate of multiple metastases and consequent futility of attempting curative surgery in most cases.

stomach. The presence of an abdominal mass or a palpable metastatic supraclavicular lymph gland is a gross sign of incurable disease. Therefore, physical findings are not particularly important for the purposes of this discussion.

Laboratory Procedures. The absence of free hydrochloric acid is still perhaps the most helpful laboratory finding. There has been an increase in the reliability of the test even though methods have changed but little. (Table v, Fig. 3.)

TABLE V
GASTRIC ANALYSIS

	1917 to 1937	1938 to 1945
Total Cases	31	29
Analyses done	18 cases	16 cases
Free HCl before and after test meal	6 cases	0 cases
No free HCl on fasting specimen, but after test meal or histamine	2 cases	0 cases
No free HCl before or after test meal or histamine	10 cases	16 cases
Presence of blood in specimens	.....	7 cases

Macrocytic anemia of the hyperchromic type described as occurring in carcinomas which destroy gastric mucosa was not evident in these cases despite the large size of some of the growths. Some degree of anisocytosis and poikilocytosis was observed, but no anemia of the "pernicious anemia type" was found. The average hemoglobin determination was 63.7 per cent of normal, and the average erythrocyte count was 3.6 million cells per cubic millimeter. This yields a color index which is in no way remarkable.

Examination of feces was not particularly helpful in most cases, nor was the leukocyte count of value in diagnosis.

Roentgenological Studies. The prominent place of *x*-ray in the diagnosis of cases of carcinoma of the stomach is undisputed. The usual methods, that is, fluoroscopy and multiple films, have not changed radically in recent years. From our 1917 to 1937 cases twenty-four out of twenty-eight barium meals suggested the diagnosis which was ultimately proved at operation or autopsy. This represents *x*-ray accuracy of 85.7 per cent. This is quite a good record, particularly so since the earlier years are included. Of the four cases not diagnosed by *x*-ray during this period one was a colloid carcinoma; the second was an adenocarcinoma, grade IV on the posterior wall of the stomach;

TABLE VI
X-RAY STUDIES

	1917 to 1937	1938 to 1945
Number of cases in which *x*-ray studies (G-I series) were made	28	19
Number of cases in which *x*-ray suggested diagnosis	24	18
Number of cases *x*-ray failed to show lesion at a time when symptoms were present	4	1
X-ray accuracy (per cent)	85.7	94.8

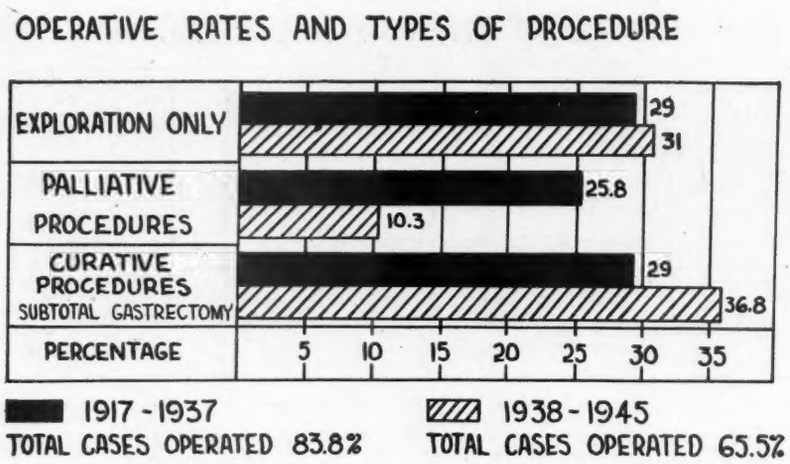


FIG. 5. This chart reveals an excessively high operative rate, but a reasonable gastrectomy rate.

the third was a carcinoma of undetermined type situated one-half way between the cardiac and pyloric orifices; and the fourth case was an adenocarcinoma, grade III, located in the antrum and pyloric regions. There seems, from these cases at least, to be no particular tumor site or type of histopathology which consistently evades *x*-ray diagnosis. During the past seven years the *x*-ray accuracy has been elevated to 94.8 per cent, with only one case of nineteen being missed. The error was made in a case which presented an adenocarcinoma, grade III, located in the pyloric antrum.

In four cases the *x*-ray report was inconclusive when the first study was done, the diagnosis finally being arrived at by repeated gastrointestinal barium series. This is a further argument for using a laboratory method as an aid, not as a final answer. Also, it serves to emphasize the importance of repeating a negative test because of the persistence of symptoms. (Table VI.)

Pathology. Two-thirds of all the cases were found to be primary adenocarcinoma. Of these two-thirds, one case revealed concomitant primary carcinoma of the rectum. Three of the adenocarcinomas were of the linitis plastica type, and two of the tumors originated within pre-existing polyps.

Of the other 33.3 per cent of all cases, there were only two scirrhous carcinomas and one case diagnosed as carcinoma simplex. There was one, also, called simply colloid carcinoma. In sixteen cases no positive microscopic diagnosis was made.

One case, included among the adenocarcinomas, was found to arise from Brunner's glands of the duodenum. Another adenocarcinoma presented a superimposed abscess.

TABLE VII
METASTASES
Occurrence of Metastases
1917 to 1937

Metastases (demonstrable)	25
No demonstrable metastases	6

1938 to 1945

Metastases (demonstrable)	16
No demonstrable metastases	13

Distribution of Metastases 41 Cases (1917 to 1945)

	No.	Per Cent
Regional nodes only	14	34.14 of metastatic cases
Lung only	1	2.43
Diaphragm only	1	2.43
Mediastinum and bone marrow only	1	2.43
Multiple metastases	24	58.53
		100

The average diameter of all lesions was slightly greater than 7 cm. This seems rather large but is in keeping with the high mortality rate. It is remarkable that tumors should attain such size without creating earlier symptoms. There is no

apparent correlation between the size of tumors and the type of histopathology.

The pathological picture and, by consequence, the prognosis, is made even less hopeful when the occurrence of metastases is considered. Only 31.6 per cent of the cases were apparently free from metastases by gross examination before and during operation. In other words, over two-thirds of the cases revealed metastatic carcinoma at a time when surgical cure was to have been attempted. Of these, 58 per cent of the patients had multiple metastatic lesions. (Table VII, Fig. 4.)

These discouraging points are brought into even sharper focus and are adequately explained by a consideration of the type of tumor cells which form a carcinoma of the stomach. The extreme anaplasia is evidenced by the fact that twenty-five out of sixty cases were described by the pathologist as grade III or grade IV malignancies.

Operative Therapy. In the light of the present knowledge of malignant gastric growths it is obvious, and universally accepted, that the only worth while treatment is surgical treatment. In other words, the only hope for cure is radical excision of the tumor and, if ablation proves impossible, a palliative procedure frequently is indicated. Palliative procedures are done most often for obstructing carcinoma near the pyloric or cardiac orifice; for the former, gastroenterostomy is done, and for the latter, simple gastrostomy.

Of the thirty-one cases from 1917 to 1937, a total of twenty-six patients were subjected to an exploratory operation. Such a high operative rate (83.8 per cent) is not justified when consideration is given to the high rate of cases explored only (29.0 per cent) and those eligible for palliative surgery only (25.8 per cent). This leaves only nine patients (29.0 per cent of total) on whom a curative operation was attempted. On 7.6 per cent no surgery of any kind was employed.

Of the twenty-nine cases from 1938 to 1945, a total of nineteen patients (65.5 per cent) were operated upon. This represents a decline of 18.3 per cent over the earlier group even though slightly earlier cases probably were treated. Exploration only was done in nine patients (31.0 per cent), again a slight leaning toward a more conservative, if pessimistic, policy. On the other hand, only three (10.3 per cent) of the operations performed were palliative procedures. A total of seven (36.84 per cent) curative operations were attempted, an increase over those in the earlier group. (Fig. 5.)

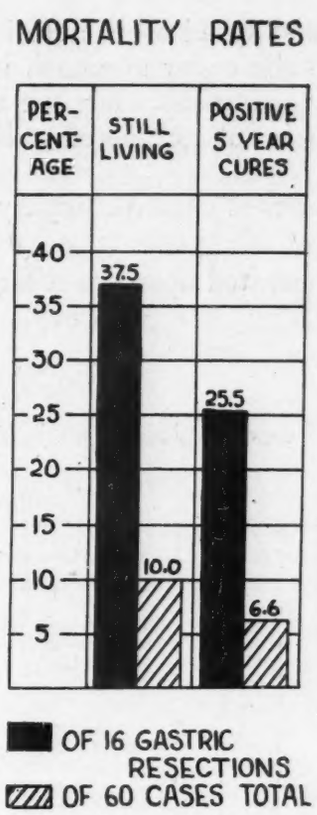


FIG. 6. The mortality rates shown here are most depressing yet they are fairly typical.

Pólya type resections have been performed at this hospital since 1921. There has been little change in the actual technics since sleeve resections with gastroduodenostomy proved unsatisfactory and the various forms of Billroth II subtotal gastrectomy were substituted. There has been a gradual change from posterior to anterior (antecolic) gastrojejunostomy, however. The main reasons for this are

the ease and speed of an anterior anastomosis and the easier approach in possible secondary operations when the anterior is used. This is not considered to be a major point.

The results of curative surgery are poor. A total of six patients of the sixteen patients operated upon are still alive. This yields an apparent survival of 10 per cent. However, two patients have not yet reached the five-year postoperative stage, yielding a corrected positive survival of at least 6.6 per cent of all the cases analyzed. It is, nevertheless, 25 per cent survival among those cases on whom curative surgery was attempted. (Fig. 6, Tables VIII and IX.)

SUMMARY AND CONCLUSIONS

Carcinoma of the stomach as seen, diagnosed and treated in a community hospital over a period of years has been considered. Cases have been carefully analyzed and reviewed in an effort to determine at what point in the disease an earlier diagnosis might have been made. The inevitable conclusion is that present methods are sadly inadequate, and this paper merely emphasizes such a conclusion. A similar and equally discouraging situation is evident in regard to treatment. Numerous types of gastric resection have been attempted with encouraging results only insofar as the immediate postoperative condition is concerned. Surgical cures

TABLE VIII

CARCINOMA OF THE STOMACH

1917 to 1938 (31 cases total)

Number of cases explored—26. Explored only—9. Number of palliative operations—8. Number of curative procedures—9

Synopsis of Curative Procedure Cases

Case	Year	Age	Sex	Site of Tumor	Type of Tumor	Metastases	Operation	Result
J. M. 12619	1921	44	F	Whole pyloric antrum extending to pyloric orifice	Carcinoma simplex	Right lower lobe 2-24-21	Partial gastrectomy and gastrojejunostomy (Pólya) 1-10-21	Died 11-16-21, 10 mos. after operation
E. J. 43988	1932	47	F	Posterior wall of pyloric antrum extending toward fundus	Scirrhous carcinoma, grade III	None seen at operation	Partial gastrectomy with gastroduodenostomy 9-8-32	In good health 7-6-37, 5 yrs. after operation
G. L. 44791	1932	68	M	Pyloric antrum	Adenocarcinoma, grade II	Regional lymph nodes	Partial gastrectomy and gastrojejunostomy 12-7-32	Died 12-10-32, operative death
B. F. 48469	1933	58	M	Pyloric region	Adenocarcinoma, grade III	Glands on greater curvature. Definite evidence of lymphatic invasion	Resection of stomach, gastroduodenostomy 11-9-33	Working 12-7-45, 12 yrs. after operation; feeling well
L. B. 55604	1935	54	M	Posterior wall (middle)	Scirrhous	Regional nodes	Subtotal gastric resection. Gastroenterostomy (Pólya) 8-26-35	Died 8-20-35, operative death
W. P. A-173 16004	1935	66	M	Antrum and pyloric region	Adenocarcinoma, grade III	Mesenteric nodes generalized carcinomatosis, liver gall bladder, pancreas, jejunum*	Partial gastrectomy, Pólya anastomosis, gastrojejunostomy 7-27-35	Died 2-16-36. 8 months
P. N. A-3609	1936	74	M	Anterior wall	Adenocarcinoma, grades III and IV	No evidence	Sleeve resection, 11-14-36	Able to get along on careful diet 2 yrs. after operation
B. C. A-4091	1936	50	M	Middle third of greater curvature	Adenocarcinoma, grade III	Regional nodes	Gastric resection and gastroenterostomy (Pólya) 12-12-36	Died 12-17-36
H. S. H. B-3172	1937	70	M	Distal 5 cm. and pyloric region	Adenocarcinoma, grades II and III	Gastrocolic and gastrohepatic omentum	Gastric resection and gastroenterostomy (Pólya) 8-24-37	Died 8-26-37

* Only mesenteric nodes involved at operation. This patient died of recurrent carcinoma.
Number of five-year cures—2.
Number of operative deaths—4.

have, in the main, not been forthcoming, even though it is acknowledged that slight increases in five-year cures have materialized. The limitations of surgical therapy are inherent in the grossness of such a system, in spite of its obvious advantages, there are many facets which reflect waste and lost motion born of a lack of central direction of effort, frequent duplication of original work and a lack

TABLE IX

CARCINOMA OF THE STOMACH

1938 to 1945 (29 cases total)

Number of cases explored—19. Explored only—9. Number of palliative operations—3. Number of curative procedures—7

Synopsis of Curative Procedure Cases

Case	Year	Age	Sex	Site of Tumor	Type of Tumor	Metastases	Operation	Result
S. B. J-1670	1945	67	F	Duodenum	Anaplastic carcinoma	None	Gastrectomy, subtotal gastrojejunostomy, antecolic	Patient losing wt. Condition poor 1-21-46
M. T. H-3278	1943	61	F	Antrum of Stomach	Adenocarcinoma, grade III, "malignant polyp"	None	Gastrectomy, subtotal gastrojejunostomy, antecolic	Condition good. Patient feeling well 1-21-46
E. W. H-1186	1943	86	F	Pylorus	Anaplastic carcinoma, grades III and IV	Gastric and pancreatic lymph nodes	Gastrectomy, subtotal gastrojejunostomy, antecolic	Died 8-27-43 5 mos. after operation
K. R. 11506	1940	58	F	Pylorus	Adenocarcinoma, grades II–III	None	Transection of stomach Gastrojejunostomy, antecolic	Died, operative death
L. W. F-1094	1941	78	F	Pylorus	Adenocarcinoma	None	Gastrectomy, subtotal (pyloric antrum) Gastrojejunostomy, posterior	Died 1 yr., 9 mos. after operation
H. H. D-523	1939	72	M	Antrum of Stomach	Adenocarcinoma, grade II liver—III		Gastrectomy, subtotal Gastrojejunostomy, posterior	Died, operative death
M. B. D-83	1939	62	F	Near fundus	Adenocarcinoma with secondary abscess	None	Gastrectomy, subtotal Gastrojejunostomy, posterior	Patient living and well 1-19-46

the available diagnostic aids and, more particularly, the absence of early symptom development.

Many groups of capable internists and surgeons have long pondered these depressing facts. It seems logical to assume that the present approach to this malignant disease will never yield satisfactory results. Small groups working along either parallel or divergent lines of cancer research represent the present method of attack. In of sufficient funds. In view of these conditions, would it not be more logical to concentrate and centralize all funds, equipment, case material and personnel available for cancer research? Such a course seems, to the authors, to be reasonable and more economical. We believe that a greater mathematical probability of developing an answer to carcinoma of the stomach would obtain under a system of co-ordinated research.

SKIN DRESSINGS IN THE TREATMENT OF DÉBRIDED WOUNDS

MAJOR ELLERY C. GAY
MEDICAL CORPS, ARMY OF THE UNITED STATES

THE work represented by this paper was done during the interval of June 1943 to March 1945, and includes the African, Sicilian, Italian, and French Campaigns.

Two series of cases are reported, one of which was done on injuries which were four to six months old. The second series was on patients whose injuries were four to ten days old. The two series of cases were completed by November, 1943, but the principles which are suggested, have been followed continuously since that time whenever applicable.

The purpose of this work is to show the use of split thickness skin grafts for battle injuries which have been débrided in forward installations, usually field or evacuation hospitals, and which are not readily amenable to secondary closure.

At the beginning of the African Campaign immediate débridement was the first surgical treatment given to these injuries. In many instances complete excision of the total area was practiced, which involved considerable loss of skin.

The function of the split thickness skin graft is to convert the large open wound into a closed healing wound as rapidly as possible. In accomplishing this end bed patients are quickly made ambulatory. In many instances combat soldiers are able to return to full duty. Patients who are to be evacuated to the Zone of Interior, over a long chain of evacuation, become much less of a nursing problem after having had these grafts.

The use of skin grafts to convert large soft tissue injuries, which have associated fractures of the long bones, into closed wounds has also been accomplished. This series of cases will be reported later.

The value of the early closure of these defects is of great importance to the orthopedic and reconstructive surgeons. By this means early operative procedures, such as bone plating or nerve repair, can be done through clean operative fields at a much earlier date.

The adequate use of split thickness skin grafts by orthopedic and general surgical services is to be encouraged. The majority of battle injuries involve extremities, and are, therefore, treated by orthopedic or general surgical services in evacuation or field hospitals. The continuation of treatment falls to the same services in the rear echelon hospitals. There is an insufficient staff of qualified plastic surgeons to care for the volume of this work over an extended area. Therefore, if the maximum number of injured are to be afforded this treatment, it would be necessary for the services handling these cases to resort freely to the use of skin grafts.

The objective, therefore, has become a problem of conversion of an open wound to a closed wound, and this is done without regard for function or esthetic appearance. The latter two factors are delegated to reconstructive surgery done in the Zone of Interior, and are purposely omitted in this paper.

The term "skin dressings" was advocated at the completion of the first series of cases, in June 1943, at a hospital in the African Theatre.

At that time a survey of the surgical patients, in the above mentioned hospital, revealed 2500 cases, checked either by record or through the daily surgical clinic. Of this number there were found to be 115 cases, who after four to six months' hospitalization, still had persistent, open

lesions, the chief defect of which was the absence of skin. Histories of the individual cases revealed that many of these wounds had reached a stagnant stage in healing and were being dressed bi-weekly. In some cases complete coverage had taken place, lasting for a period of one to seven days, with subsequent breakdown of the original wound. These areas varied in size from 5 to 15 cm. in length. Investigation by *x*-ray revealed foreign body inclusions in only a small number of cases.

During the month of June, 1943, thirty of these patients were operated, with resultant 90 per cent complete recovery. A check-up at the end of six weeks showed no breakdown of any of the wounds.

Before completion of the 115 cases, the battle front was moved to the Sicilian Invasion, and a continuation of this work was transferred to a station hospital in the Bizerte Area, which was receiving casualties on the fourth to the tenth day after injury. These fresh injuries were similar to the above mentioned old injuries, except for the time element. Had they been allowed to go unoperated upon the same condition, described above, would have resulted in the same period of time.

Seventy-one patients were operated upon during July and August, 1943. The areas involved were primarily on the extremities which had been débrided, dusted with sulfanilamide powder, and a vaseline gauze dressing applied in a forward installation.

On admission, many of these cases were classed as dirty wounds, having moderate surface infection, but relatively little spreading infection. In some, moderate fascia or tendon sloughs existed. In all of them, there was a definite tendency for profuse exudation to be present.

The majority of the cases were wet packed for twenty-four to forty-eight hours with saline packs or saturated solution boric acid packs. At the end of that time the surface infection appeared visibly diminished.

Regardless of size, depth, or basal conformation, all areas were immediately

FIG. 1. Unhealed granulating wound of twenty-six days' duration.

FIG. 2. Split thickness skin graft at forty-eight-hour dressing. Sutures have been removed.

covered with split thickness skin grafts, obtained after the Blair technic. Wounds having stellate lacerations along the margins were closed as much as possible by interrupted suturing with black silk, before applying graft to the remaining areas. The dependent portions of the wounds, or lateral areas of undermining which were produced in some instances by the partial secondary closure, were drained by means of small strips of rubber dam drain. In several instances, holes were made through the sheet of graft, so that a drain could be placed in a cavity or recess through the graft.

Muslin strips, lightly coated with vaseline, were applied to all grafts in terrace fashion whether sutured or just laid on the defect, followed by the application of sponges, waste, or ABD pads. A pressure bandage was next applied, followed by complete adhesive strip covering. Im-

FIG. 3. Split thickness skin graft applied to "v"-shaped wound of thigh (fifteen days after application).

FIG. 4. Irregular stellate wound with uneven trough-like base. Partial closure and graft were done simultaneously; appearance on fifteenth postoperative day.

mobilization was accomplished where advisable, by light plaster splints. Ace bandages or stockinette can be used satisfactorily.

In the first wounds grafted, the dressings were left undisturbed ten to fourteen days, but in all of these an excessive amount of exudation was evident, and it was believed that a portion of the grafts were lost because of this.

By trial and error method, it was found that 80 to 100 per cent take of the grafts was obtained, if dressings were changed at forty-eight-hour intervals. Those cases with moderate surface infection were continued on wet packs during the dressing intervals. All dressings were done in the operating room, because of the excessive dust and wind of that location during that season.

It was found that complete healing occured as early as fourteen days, but the average for the entire group was twenty-eight days.

By this time all patients without lower extremity fractures were ambulatory. Those with complicating factors, demanding Zone of Interior evacuation, left the hospital with all areas healed and covered with skin. Many patients returned to full duty.

Tabulated estimations of the results of "take" of the grafts are as follows: Complete take sixty-two or 87 per cent; partial take (50 per cent or over) three or 4 per cent; total failure six or 8 per cent.

COMMENTS

These split grafts were applied with the sole intent of giving skin coverage to open wounds. In some areas the grafts were placed directly in contact with fascia, muscle belly, or exposed periosteum, according to the amount of soft tissue loss.

It must be repeated that neither the functional nor the esthetic end result was given a place of primary importance.

During the course of this work, several clinics were held, and cases both good and bad demonstrated. The predominant question raised was "Why are not most of these cases suitable for secondary closure?"

Some of them may have been, but not without wide undermining of skin margins, which open possibilities for additional infection in an already infected wound. The grafts were placed on the wounds in the presence of this infection, knowingly.

It is good reasoning that any area which can be closed secondarily, is in better condition than a grafted area; but most of the wounds so grafted were large, excised, avulsed or saucerized lesions which would have been exceedingly difficult otherwise. There is every reason, therefore, why this procedure should act as a complement to the General Surgical Service instead of over-riding it.

Another question was "gas gangrene possibilities." The observation is made that the optimum time for these grafts is between the fifth to the tenth day after injury. Preliminary, adequate débridement plus the use of penicillin, in questionable cases, has kept the number of cases of gas gangrene at a minimum. Some cases of gas have developed as late as thirty days after injury in wounds secondarily closed. These are the exceptional cases and cannot be foreseen. No reports are on record of gas gangrene in a grafted extremity thus far observed.

The clinical appearance of the patient, and the wound, was examined thoroughly before grafting, but bacteriological studies of the wounds were not done. Those wounds which visibly were extremely infected responded satisfactorily to wet packs over a twenty-four to forty-eight-hour period preoperatively. Grafting was not delayed beyond forty-eight hours because of infection, or even moderate sloughing of underlying structures.

To verify these findings, the general surgical service was asked to cooperate. They chose fourteen cases which were not suitable for secondary closure. Of these, thirteen were entirely successful while one failed.

During this period, the services of the Army Pictorial Service were available for a limited period of time, on limited occasions. Films were obtained on six cases. These cases are given briefly as follows:

Fig. 5. Combination procedure of sliding flap graft, partial closure, and split thickness skin graft with drainage by tissue dam at time of grafting; appearance on tenth postoperative day.

CASE REPORTS

Case 1. This case represents the type of lesion seen in the late stages of healing. and such as was found in the original survey. The original injury was twenty-six days prior to admission to this Hospital, and was a shell fragment laceration.

At the present time (Fig. 1) there is a painful, unhealed area on the medial aspect of the left knee, which according to the history has reached a stagnant period of recovery. There is a weeping granular base present in the center. This area is small in comparison to the greater number of cases operated, but is one of the few in which both pictures are available.

By comparison, it is estimated that an additional twenty to thirty days would be required for healing.

The margins of skin were excised and the base scraped lightly. A split skin graft was applied. Figure 2 shows the extent of excision and the condition of the graft at the end of forty-eight hours. Sutures have been removed. Several small stab drain areas can be seen in the graft. This patient was entirely healed in sixteen days. He returned to limited duty in twenty-six days.

FIG. 6. Large irregular defect 1½ inches deep completely covered by split graft, which was applied directly to muscle belly and fascia; appearance on sixteenth postoperative day.

CASE II. This patient was admitted to the Hospital eleven days after injury by a shell fragment, which tore medially across the thigh and avulsed a section of skin and partially transected the quadriceps muscle. There was gross infection present. The first treatment had been débridement, application of sulfonilamide, and vaseline gauze dressing lightly applied. He received boric acid packs for twenty-four hours preoperatively. Under spinal anesthesia a split skin graft was taken from the right thigh and applied to the depressed wound. Sutures of black silk were used. He was dressed at forty-eight-hour intervals and by the thirteenth day was healed and ambulatory.

The graft (Fig. 3) is adherent to both muscle and fascia. Movements of the leg are not limited or painful. On the fifteenth day, when the photograph was made, the patient was assisting with ward work. This is not a desired esthetic result, but the function is satisfactory and the area is without pain.

CASE III. This patient was admitted to the hospital on the seventh day after injury. A shell fragment had lacerated the left gastrocnemius area. Primary treatment had been débridement and application of vaseline gauze dressings. There was moderate infection present and also some slough of muscle fibers and fascia on admission. Preoperative treatment of forty-eight-hour boric acid packs was used.

The operation consisted of secondary closure of the medial and lateral stellate areas of the wound, using black silk. The remaining area was covered with split skin graft, with a small tissue drain in one dependent area of the middle of the graft. This was done under spinal anesthesia. Figure 4 was made on the fifteenth postoperative day. Irregular depressed areas in the middle of the graft are still visible. He was ambulatory on the seventeenth day and was discharged on the twenty-fifth day.

CASE IV. This patient was admitted to the hospital on the eighth day after injury. There was an extensive and deep soft tissue injury of the left mid biceps region, with both the biceps and triceps visible. There was infection and slough present on admission. Primary treatment had been débridement, sulfonilamide powder, and vaseline gauze dressings.

The operation consisted of a sliding full thickness graft from the lower portion of the wound, which was advanced superiorly to meet the secondarily closed upper area. A drain was inserted at this junction. The lower portion, which included part of the original wound, was covered by a split graft. Two small drains were brought through the graft in this area. Dressings were at forty-eight-hour intervals. There was complete healing in eighteen days. Complete function existed in twenty-eight days. Figure 5 was taken on the tenth postoperative day.

CASE V. This patient was admitted to the hospital fourteen days after injury. He had a large avulsed area of the inner aspect of the right thigh produced by a shell fragment. There had been wide incision and débridement of the area. The wound appeared to be at least one and one-half inches deep. Moderate surface

Fig. 7. Irregular stellate wound with partial avulsion of portion of first metatarsal, exposing periosteum and bone.

Fig. 8. Split graft applied to "v"-shaped defect, directly in contact with periosteum and bone; entirely healed on fourteenth postoperative day; appearance on fourteenth day.

infection was present. He received boric acid wet packs for forty-eight hours preoperatively.

The operation consisted of the application of a large split graft removed from the opposite thigh. This was sutured with black silk. Three drains were used through the graft and several small stab drains were cut in the graft. Spinal anesthesia was used. The graft was healed in sixteen days with exception of three or four small buds of granulation which protruded through the stab drain areas. These quickly bridged. (Fig. 6.) The patient was discharged to light duty on the twenty-third postoperative day.

Case VI. This case, though small, is shown because of its relationship to orthopedic problems. The patient was admitted to the hospital on the ninth day after injury, received from a personnel mine. On admission there was moderate infection present, in the injury of his left foot. He had had a débridement, sulfonilamide powder, and vaseline gauze dressings as a preliminary treatment. The injury avulsed a section of the first metatarsal and that area is visible in Fig. 7. The lesion extended onto the plantar surface of the foot. He received wet boric acid packs for forty-eight hours preoperatively.

The operation consisted of partial secondary closure of the plantar surface, and the application of a split graft into the V shaped wound of the medial border. There was no excision or débridement at the time of operation.

Figure 8 was made on the fourteenth postoperative day, and shows the graft entirely taken even over the area which showed exposed bone and periosteum.

This patient was scheduled for Zone of Interior evacuation, and was evacuated with completely healed wounds, which did not require additional nursing care.

SUMMARY

A series of 101 cases of the application of split thickness skin grafts is reported.

Six of these cases are reported in brief with photographs.

These cases show 87 per cent successful takes of the grafts.

The relationship of this work to general surgery and to orthopedic surgery is discussed.

The entire effort is based on an attempt to convert large tissue defects, received in war injuries, into rapidly healing closed wounds, which shortens the patient's period of hospitalization and convalescence, and returns him early to limited or full military duty, or allows for more comfortable evacuation to the Zone of the Interior.

CONCLUSIONS

The optimum time for the use of split skin grafts as a "skin dressing" to large

tissue defects, received as war injuries, is between the fifth to the tenth day after injury.

These grafts are practical in the presence of excessively exuding wounds, and also in the presence of mild surface infection.

These grafts may be used as combination procedures involving drainage of dependent areas, partial secondary closures, and skin grafting.

A dressing program of forty-eight-hour intervals seems to offer the greatest opportunity to combat excessive exudation, which is a predominant feature of massive war wounds; this technic offers most protection to the grafts applied.

Grafts used for this purpose should be very thin, since the thin split thickness graft shows a higher percentage of complete takes, in the presence of excessive exudation or moderate infection, than the deep intermediate grafts.

The donor areas of thin grafts are less likely to become secondarily infected and heal without delay.

Failure of these grafts is attributed to retained foreign bodies, and/or excessive infection as a result of deep penetrating wounds, not thoroughly opened in the primary débridement of the wound, or missed, during inspection of the wound.

These grafts are not to take the place of secondary closures, but serve as an adjunct to general and orthopedic surgery in the care of war injuries which involve massive loss of skin surface.

The time necessary for the consummation of this work lies within a thirty-day period. It is, therefore, applicable in any installation which is functioning on a thirty-day, or more, basis.

The potentialities of the use of split thickness skin grafts, applied early in the treatment of war wounds, should be easily transcribed to traumatic surgery of civilian practice.

REGIONAL ANESTHESIA*

ITS ADVANTAGES IN EMERGENCY SURGERY OF THE EXTREMITIES

GERARD A. P. HURLEY, M.B., F.R.C.S. (C)
MONTREAL, CANADA

THE success or failure of any surgical procedure depends in no small measure on the suitability of the method of anesthesia employed; and the comparatively large number of methods and agents of anesthesia in use today is proof enough that there is no such thing as the ideal and universal anesthetic suitable to all patients and all conditions.

Ever since the epoch-making discovery of the anesthetic powers of ether by Morton and Long nearly one hundred years ago, until the comparatively recent introduction of spinal anesthesia, general inhalation anesthesia has held the field. It has, however, in the past two decades largely given ground to the method of spinal anesthesia or spinal cord block. In some of the best known surgical centers today the majority of lower extremity and abdominal operations, and much of the major surgery of the thorax, are done under spinal anesthesia. While on no account trying to minimize the unprecedented boon that inhalation anesthesia has proven to be, one cannot help pointing out that it seems unjustifiable in some of the shorter and more restricted operations and manipulations to induce unconsciousness and anesthesia of the whole body when only the restricted field of operation need be rendered insensible. This is particularly true of emergency surgery in which, owing to the curtailment of time, some of the important factors in the routine preparation for general anesthesia, such as the empty stomach and thorough evaluation of the constitutional status, must of necessity be dispensed with.

In this article, it is proposed to point out some of the advantages that pertain to the use of regional anesthesia in particular as it applies to the emergency surgery of the extremities.

Anesthesia of a region of the body may be achieved by regional nerve block, field block or local infiltration. Regional nerve block is at its best in operations on the extremities, head and neck. Field block, or the creation of a zone of anesthetized tissue in which are included the nerves to the part, between the central nervous system and the field of operation, has its greatest usefulness in operations on the thorax or abdomen. Local infiltration may be used in any region of the body. Certain objections are made to its use in any condition involving infection or contamination of the part being operated upon. The flooding of the tissues and consequent opening up of the tissue spaces by the anesthetic fluid in the region of infection or contamination (as in the case of a dirty wound), is believed by many to favor spread of infection or contamination to hitherto unaffected parts of the anatomy. Moreover, one is loath to plunge an infiltrating needle through the skin of the injured hand or forearm, the cleansing of which has been necessarily incomplete due to the pain involved. No such objection exists to injection of the brachial plexus through the skin of the supraclavicular fossa, which, being remote from the injured area, can be scrubbed as thoroughly as necessary. For this reason, as well as the more widespread, complete, and efficient anesthesia achieved, regional anesthesia is believed to be preferable to local anesthesia in operations on the extremities.

Field block or local infiltration may occasionally be used with advantage to

* From the Surgical Service of Dr. Fraser B. Gurd, the Montreal General Hospital, McGill University.

supplement or reinforce the regional form when a certain plan of procedure is adopted. This involves the establishment of anesthesia of the part by the regional nerve block whereupon thorough cleansing of the traumatized region can be carried out painlessly. The nerves to certain isolated areas of the field of the operation may have been only lightly touched by the regional block higher up, and the anesthesia may begin to wear off early in these areas; but with the part now thoroughly clean, there is no objection to the use of a supplementary field block somewhat proximal to the operative field, or even local infiltration, to render these parts again insensible. Such reinforcement, however, should be unnecessary as a general rule.

One might mention some of the less important points in favor of regional anesthesia. Throughout the operation one has the cooperation of the patient, a factor of some importance in operations such as tendon or nerve suture. One may make use of electrocoagulation for the rapid and efficient control of bleeding in large wound surfaces since the risk of explosion is not present. Furthermore, on grounds of economy alone, the argument is strongly in favor of regional anesthesia. Certain advantages seem to pertain to the use of regional anesthesia in traumatic surgery. The simple nature of the equipment required makes the method suitable for all types of practice. It is universally admitted that early operation is of prime importance in dealing with wounds and it is believed that operation can be undertaken sooner with greater safety in these cases if one uses the regional method of anesthesia.

One should consider certain possible objections to the use of regional anesthesia. The most often quoted objection is the high percentage of cases in which inadequate anesthesia is attained. A moment's consideration will show that this objection derives not from the method but from the person using or rather misusing the method. Anesthesia is undeniably adequate when the anesthetic fluid is brought in contact with the nerve or nerves to be blocked and if anesthesia is not obtained it means that this essential was not obtained. Thus absence or insufficiency of anesthesia is due not to a fault of the method but rather to a fault of the operator. Allowing for the very small percentage of cases in which the large nerve trunks lie in unusual situations, the finding of the nerves with the needle point constitutes no problem for anybody with an average knowledge of anatomy who is guided by the rules of the technic. Certain other objections may be offered such as the possibility of the patient being sensitive to novocaine, the most frequently used agent for regional anesthesia. This sensitivity is so rarely met with as to be of very little consequence. Moreover, it is recognized early and rarely constitutes a danger to life. One does occasionally encounter transient tachycardia, tremor and feelings of nervousness. These signs are less frequently seen if preliminary sedation and barbiturate (nembutal) is adopted. They rarely require any active measures to combat them, but a few cc. of intravenous barbiturate (pentothal sodium) will quickly control a reaction of any magnitude. There is, of course, the possibility of the injection of novocaine into a vein by a careless operator with resulting circulatory collapse. This is easily avoided by exercising average care in technic. One should never inject novocaine into the tissues without applying the aspiration test, i.e., withdrawing the plunger of the syringe a little before injecting. If the point of the needle is resting within the lumen of a blood vessel, blood will be drawn into the syringe.

The question of injury to the deeper structures is of more importance in the case of brachial plexus block than in sciatic block. The subclavian artery has been punctured several times in the present series but in no case has any permanent damage resulted, and the accident has never constituted anything other than a

nuisance. It usually occurs toward the end of the injection as the lower trunk of the plexus is being searched for. It is more of a problem in those rare cases in which it occurs early in the course of the injection in that the resulting hematoma obscures the field and renders the aspiration test useless. It is, therefore, recommended that the injection be abandoned in such an instance.

A more formidable complication is injury to the underlying lung with resulting pneumothorax which, depending on the wound in the lung, might be of the tension variety. Pneumothorax of a very limited extent occurred in a block done for open reduction of a fracture of the olecranon process of the ulna. That case is not included in the present series because it was not an emergency operation. Two hundred cc. of air were aspirated from the left pleural cavity at once, the patient was returned to the ward and no further trouble resulted. Such a complication should be rarely seen and should be easily dealt with when it occurs.

It is a fact that a certain small percentage of patients, by reason of their mental make-up, are unsuitable for the exhibition of any form of anesthesia other than the general type. These patients, an extremely small minority, are not capable of standing the strain of being operated upon while retaining full consciousness. Even after the administration of powerful doses of the usual sedatives they are still so overcome by fear of the suffering which they anticipate, that they cannot or will not adjust themselves to the method. A considerably larger number of patients of a nervous disposition also are not ideal subjects for local, regional or spinal anesthesia. In these cases, however, the difficulty can be readily overcome by the administration of adequate doses of the usual sedative drugs. Even for the average patient, preliminary sedation in considerably larger dosage is required when subjected to operation under the influence of local, regional or spinal anesthesia than would be the case were the anesthetic a general one.

An important general principle should be stated here: Regional anesthesia is at its best when only one region of the body is being operated on. The more regions that require anesthesia the less suitable becomes the regional and the more suitable becomes the general method, speaking from the purely anesthetic standpoint. In this account which deals only with the surgery of the extremities, two regions will be dealt with specifically: (1) the upper extremity distal to and including the shoulder joint, and (2) the lower extremity distal to and not including the knee joint.

For (1), block of the brachial plexus in the supraclavicular fossa is usually adequate. In the occasional case of wounds of the skin and subcutaneous tissues high up in the region of the point of the shoulder, a supplementary field block of the supraclavicular and supraacromial branches of cervical nerves three and four is indicated. In superficial wounds of the inner part of the upper arm, the intercostobrachial nerve can similarly be interrupted easily by a half-bracelet type of subcutaneous field block proximal to the seat of the injury on the inner hemi-circumference of the arm.

For (2), block of the great and small sciatic nerves in the gluteal region is adequate usually. The small sciatic nerve (posterior cutaneous nerve of the thigh) lies on the great sciatic nerve in the gluteal region and both nerves are blocked by the same injection. In an occasional case with wounds of the inner side of the leg and proximal part of the inner side of the foot, a supplementary half-bracelet subcutaneous field block of the inner hemi-circumference of the leg to interrupt the long saphenous nerve will be required. The lower extremity above and including the knee joint is less suitable for regional anesthesia than regions (1) and (2) because its nerve supply is less compactly arranged.

PRELIMINARY SEDATION

The importance of the preliminary sedation to the success of the method has been emphasized already, and some of the points which should be considered in order to determine the appropriate type and amount of premedication have been mentioned. Although it is impossible to give specific instructions here as to this aspect of the question for every particular case, the main points of importance will be mentioned and certain generalities will be stated about each.

A combination of barbiturate (nembutal) and morphia has been found to be the most satisfactory premedication. For the average 160 pound young adult male, 3 gr. of nembutal by mouth, together with ¼ gr. of morphine sulphine subcutaneously, are given one-half hour before the operation. For the average young adult female of 130 pounds the same time and the same dosage of morphia are observed, but only 1½ gr. of nembutal are given. The range of dosage of morphia will vary from ⅛ gr. to ¼ or even ½ gr. in divided doses, and that of nembutal from ¾ gr. to 3 gr., depending on the following considerations:

Age of Patient. As a rule, the older the patient the less well are morphia and more especially nembutal tolerated, and fortunately these drugs are less necessary in the aged. For patients over fifty-five years of age the nembutal can usually be dispensed with and ⅙ gr. of morphia alone will be found adequate. Children in their teens may be given ⅙ gr. of morphia together with 1½ gr. of nembutal.

Sex of Patient. Little difference has been found between the sexes in their suitability to regional anesthesia and the choice of the preliminary medication.

Weight of Patient. Other things being equal, the dosage is increased with increase in weight.

Mental Make-up of Patient. This is the most variable characteristic and also one of the most important to be considered in grading the dosage. The latter must be appropriately increased in the apprehensive, excitable patient who may in addition be somewhat unbalanced as a result of the accident. An appropriate reduction can be made in the amount of the preanesthetic drugs in the case of phlegmatic individuals who have little fear of the operation, and who have accepted their accident as a nuisance rather than a calamity.

PRINCIPLES OF THE TECHNIC

The actual technic of the injection is best learned through a period of preliminary training under supervision on the living subject, or without supervision on the cadaver. There are certain inherent dangers in plunging a needle deeply into almost any part of the body, and the operator must know the dangers and how to avoid them. The best and safest place to learn the approach by needle to the deeper parts of the anatomy is in the dissecting room. Failing this, and not everybody has ready access to a dissecting room, the next best plan for the beginner in the use of regional anesthesia is to have practical instruction on the living subject from one who is already proficient in the method. However, the operator who carefully follows the rules of the approach will rarely if ever meet with serious trouble.

The most valuable guides by which one's path is directed in deep injections are constituted by the landmarks, superficial and deep, presented by certain parts of the bony skeleton. The superficial landmarks are those prominences easily palpable and occasionally visible which lie in the immediate neighborhood of the field of injection. Perhaps more important are the deep, bony landmarks which are not always palpable and never visible, but which can be sought out by the exploring needle point. The superficial landmarks constitute the rough guides to the approach. The deep landmarks, in that they lie nearer to the structure sought after, constitute the fine adjustment in the process. They have, however, an even more important function in that they often

constitute a protection and safeguard for the more vulnerable soft parts in the neighborhood. Thus, for example, in the case of brachial plexus block, the point of the needle is never intentionally allowed to deviate from the flat upper surface of the first rib which forms a convenient barrier of protection for the underlying pleura and lung. The outer, bony surface of the os inominatum similarly constitutes an efficient armor for the pelvic viscera in the case of sciatic nerve block.

Apart from the care needed to be taken with the actual injection, the surgeon operating with this method of anesthesia must of necessity be as gentle and painstakingly accurate in his movements as is humanly possible. All undue pulling or pushing will be a source of discomfort to the patient even though he does not feel any sensation of pain as such.

A practice must be made of checking on the adequacy of the preliminary medication shortly before the block injection is begun. Should the required state of oblivion be not attained at this time, the operation should not be proceeded with at once. An additional dose of morphia should be given and care taken that the patient is thoroughly under the influence before the needle touches the skin. Disregard of this precaution is one of the most frequent causes of failure or half success in the use of spinal, regional or local anesthesia. A convenient way of giving this eleventh hour sedation is to dissolve ¼ gr. of morphia sulfate in 2 cc. of normal saline. This is then administered intravenously in divided doses as required.

Another factor of considerable importance is constituted by the patient's immediate surroundings in the operating room. The whole atmosphere of the place must be as tranquil and quiet as possible. Imprudent rattling of the instruments or banging of sterilizing equipment may constitute a terrifying experience for the patients and is an unpardonable offense. Incalculable harm may be done by well meaning but imprudent queries such as "does it hurt?" Even if it does not hurt, the putting of such a question suggests at once to the patient that he is being subjected to a procedure which ordinarily does hurt and in not a few instances he promptly obliges the questioner by feeling pain which does not exist. In the great majority of cases the patient will of his own accord readily let the operator know if he is experiencing pain. This is an instance of the power of suggestion acting in a deleterious sense. This same power can, however, be a great aid when used to supplement the method of regional anesthesia. If, in brachial plexus block, it is suggested to the patient that the nerves going to his upper limb are going to be injected "so as to make the whole arm and hand go to sleep" a valuable adjunct to the anesthetic power of the novocaine may be brought into effect.

DETAILS OF THE TECHNIC

In doing a nerve block one prefers to make the injection endoneurally or directly into the nerve trunks. By this method the most complete anesthesia is attained in the shortest time, usually within five minutes of completing the injection. A skillful operator will succeed in making the injection an endoneural one except in rare instances when, owing to obesity of the patient or to abnormality of the part, the nerves are not so readily accessible. In such instances one has to be content with a perineural injection, the anesthetic fluid being deposited in the immediate neighborhood of the nerves. If a sufficient amount of anesthetic fluid is injected near the nerves, the anesthesia will be quite adequate but will take longer to become established. In these cases one injects half as much anesthetic fluid again as is required for the endoneural block, and a period of twenty minutes is allowed to elapse before anesthesia is judged to be adequate.

A 10 or 20 cc. syringe with a hypodermic needle, and a No. 20 bore needle, one and one-half to two inches in length is

Fig. 1. Position for brachial plexus block.

required for the brachial block. For the sciatic block a much longer needle, four to five inches in length, is required. The usual lumbar puncture needle suits the purpose well. (Fig. 1.)

Brachial Block. Position: The patient is placed supine on the table with the arms by the side. The hand is grasped by an assistant and pulled toward the feet so as to depress the clavicle. The face of the patient is turned away from the side in question and the head is placed as far as possible to the other side. This gives a good exposure of the supraclavicular region.

Approach: The superficial landmark is the mid-point of clavicle; the deep landmark is the upper surface of the first rib.

The side of the neck and the upper part of the chest are then prepared with skin antiseptic. The supraclavicular region is draped with three linen towels, leaving the full length of the clavicle exposed. By palpating deeply above the middle of the clavicle one can feel the resistance offered by the flat upper surface of the first rib at or about the junction of its anterior and middle thirds. At this point the rib curves backward around the base of the neck and is perhaps somewhat more medially placed than one would expect. The mid-point of the clavicle is identified and an intradermal wheal of anesthetic fluid is raised with the hypodermic needle just at the upper border of the clavicle at this point. The longer needle to which the syringe is attached is now plunged backward, very slightly inward, and slightly upward so as to impinge on the upper surface of the first rib.

Perhaps a good rule to follow in guiding the needle is to direct it at right angles to the line of the middle one-third of the clavicle, or more exactly at right angles to the plane of the anterosuperior surface of the middle one-third of the clavicle at its mid-point. It should be noted that the general line of the middle one-third of the clavicle is quite distinct from the line of the outer one-third, which portion curves rather sharply outward and somewhat anteriorly, and from the line of the inner one-third which runs outward and slightly posteriorly. The general direction of the middle one-third is outward and definitely posteriorly. Again, the clavicle at its mid-point has three surfaces: an anterosuperior, a posterior and an inferior. The above rule, taking into account the anterosuperior surface and middle third of the clavicle, while not mathematically accurate, will be found of considerable help in finding the upper surface of the first rib, while palpation of the rib is a further guide.

It must be emphasized that the whole success of the procedure, both for the accuracy as well as the safety of its performance, depends on finding the first rib and in not permitting the point of the needle to deviate past its flat upper surface. This is the important deep landmark which tells the operator where the point of the needle lies, and it is at the same time the barrier protecting the dome of the pleura, the apex of the lung and the

other important structures of the upper mediastinum.

In a majority of cases the point of the needle will strike the first rib less than 2 cm. lateral to the trunks of the brachial plexus where these structures cross the rib passing downward and outward to the upper extremity. Occasionally, the point of the needle will hit the plexus at once before it meets the rib and more rarely still the point of the needle will be placed medial to the plexus. As soon as the nerve trunks are touched by the needle the patient will feel a tingling sensation or "shock" down along the extremity in the distribution of the nerve touched.

Should the point of the needle not hit the plexus at its first insertion along the line indicated, the needle point is shifted gradually outward and backward along the surface of the rib for a distance of 1 to 1½ cm. so as not to miss the plexus in those rare cases in which it is more laterally placed than usual. The plexus not being found in this region, the point of the needle is next moved in steps of ½ cm. at a time medially along the surface of the rib and within a distance of 1 or 2 cm. of the point at which the rib was originally touched, the plexus will be found, and the patient will report the "shock." It should be noted that the brachial plexus in its relation to the first rib is placed lateral to the subclavian artery which is, in turn, somewhat lateral and posterior to the subclavian vein. Thus, if one moves the point of the needle in steps of a few mm. at a time inward along the rib, one must needs touch the plexus before one meets the subclavian artery. Thus it is that injury to the subclavian artery is made less likely in the same way as injury to the underlying pleura and lung is obviated by making use of the protection offered by the first rib.

The width of the plexus at this point varies from 1½ to usually not more than 2 cm. In order to obtain the most rapid and complete anesthesia the full width of the plexus must be infiltrated with the anesthetic fluid by inserting the needle into the trunks and injecting into them the anesthetic fluid until such time as no further sensation is elicited on touching the nerves. Thirty cc. of 2 per cent novocaine are used for the adult male. On entering one of the nerve trunks with the needle point one gets a sensation of increased resistance as compared with the sensation elicited in the surrounding tissues. Having injected the plexus for a distance of 1½ to 2 cm. inward from the extreme outer limit at which the plexus was first encountered, one must be careful not to advance the needle point any further medially lest one should enter the subclavian artery. It should be noted that the anterior end of the first rib passes downward and inward deep to the clavicle; and as the lower trunk of the plexus is injected, the point of the needle will be directed backward slightly inward and increasingly downward deep to the clavicle.

Fig. 2. Position for sciatic nerve block.

Sciatic Block. Position: The patient is placed prone on the table with a pillow under the head, the face being turned to one side. (Fig. 2.)

Approach: The superficial landmarks are (1) the posterior superior spine of the ilium and (2) the tip of the great trochanter of the femur; the deep landmarks are the outer surface of the os inominatum as constituted by the lower dorsum ilii and upper ischium, where these bones form the bony limits of the great sciatic notch.

The buttock is widely prepared with skin antiseptic and draped with three linen towels. The posterior superior spin of the ilium is usually not a visible prominence but it can, nevertheless, be easily palpated. Less distinct by palpation is the summit of the great trochanter of the femur, which can be felt as an indistinct mass, but it is not necessary to be geometrically accurate with these superficial landmarks. These two prominences are marked by finger and thumb of the left hand and joined by an imaginary line. A second imaginary line is drawn at right angles to the original line at its mid-point. A point two finger breadths caudal to the point of intersection is then taken on the second line. This is the point of entry of the needle. The usual skin wheal is raised at this point by injecting a small quantity of anesthetic fluid under the epidermis, using the hypodermic needle.

The lumbar puncture needle is now plunged vertralward and slightly cranialward more or less at right angles to the skin until the point touches the lower dorsum ilii. The point of the needle is now moved directly medial in steps of ½ cm. Occasionally, the great sciatic nerve will be met with by the needle point before the edge of the greater sciatic notch is reached. Presently the needle point will be felt to slide over the bony edge of the great sciatic notch toward the inside of the pelvis. The needle is at once withdrawn a little and its point is then moved step by step caudalward along the edge of the notch, slipping now and again off the edge until the great sciatic nerve is touched where it emerges from the great sacrosciatic foramen and lies on the bony edge of the notch. A tingling sensation or "shock" will be felt by the patient running down to the foot and toes and the hamstrings as well as the muscles of the calf will be seen to twitch. Twenty cc. of 2 per cent novocaine are injected into the nerve at this point in the case of the adult male, and the needle is withdrawn.

The small sciatic nerve (posterior cutaneous nerve of the thigh) lies on the great sciatic nerve and is blocked with it.

ANALYSIS

Fifty-one patients were operated upon using the anesthesia techniques described. In the brachial plexus block series there were three groups: (1) *Eight upper arm cases*—four reductions of fractured humerus, two reductions of dislocated shoulder, one wound excision and reduction of compound fracture dislocation of elbow, and one wound excision and removal of foreign body; (2) *Eight forearm and wrist cases*—two reductions of fractured radius and ulna, two reductions of fractured radius (one a Colles' fracture), one wound excision and reduction of compound dislocation of radiocarpal joint with suture of ulnar nerve, two wound excisions and suture of flexor tendons and median and ulnar nerves after lacerations of front of wrist, and one amputation through junction of lower and middle one-thirds of forearm; (3) *Fifteen hand cases*—two amputations through middle, ring, and little fingers, (1) amputation through index finger, wound excision and reduction of compound fracture of terminal phalanges of middle and ring fingers, three wound excisions and reductions of compound fractures of phalanges, one amputation of thumb through proximal phalanx, one amputation through metacarpal bones of little and ring fingers and suture of flexor profundus and extensor tendons to middle finger and extensor tendon to index finger, one wound excision and reduction of compound dislocation of interphalangeal joint of thumb, one wound excision with reduction of compound fracture of proximal phalanx of thumb and suture of flexor

longus pollices and extensor longus pollices tendons, one wound excision and suture of flexor profundus tendon to the middle finger at the head of the metacarpal bone, one wound excision and suture of extensor tendons to index, middle, ring and little fingers on back of hand, one wound excision and closure of extensive lacerated wound of palm of hand and fingers, one incision and drainage of abscess on back of hand, and one incision and drainage of suppurative tenosynovitis of flexor sheath of ring finger and abscess of midpalmar space. In this series there were twenty-six males and five females, the ages varying from seven and one-half to seventy-five years.

In the sciatic block series there were seventeen reductions of fracture dislocations of the ankle, five showing marked, nine moderate, and three slight displacement. There were also four reductions of fractured tibia and fibula, two wound excisions and reduction of compound fractures of tibia and fibula (sciatic block combined with long saphenous nerve block), and one wound excision and reduction of compound fracture dislocation of ankle and reduction of fractured tarsal scaphoid, cuboid, and three cuneiform bones. In this series there were twenty-two males and four females, the ages varying from twelve to sixty-one years.

The only organic complications that resulted in the brachial plexus block series were localized gangrene of fingers in two cases, of skin of dorsum of hand in one case, and osteomyelitis of ring finger in the case of suppurative tenosynovitis. These all occurred in the hand group and it is believed that they could not be attributed fairly to the method of anesthesia used.

In the case of removal of foreign body from the left upper arm the patient complained shortly after the operation that he could not move any part of his left upper extremity. He was seen by Dr. F. H. McKay (Dept. of Neurology) who found "all sensations present in the left upper extremity with complete motor loss in hand, wrist and forearm, the only exception being a flicker of movement in thumb flexion." He suggested that "an organic basis due to compression from a very tight tourniquet (applied before admission to check bleeding from the left basilic vein) might be held responsible but that nevertheless a large functional (suggestive) element must be present." All muscles of the left upper extremity responded well to Faradism and there was no reaction of degeneration. Function quickly returned to this patient and within months he was working full time again. This was the only case to show motor weakness after operation, and in view of the above findings it seems unlikely that the nerve injection could be held responsible.

In the sciatic block series there was one case of osteochondritis dissecans of the ankle which gave an excellent final result after removal of the loose fragment of bone and cartilage. Another case of fracture dislocation of the ankle suffered re-dislocation due to too early unsupported weight bearing. This patient, a luetic, had a fair final result after reconstruction of the ankle joint. Suppurative arthritis occurred in a case of simple fracture dislocation of the ankle. The reason for this complication was unknown and a fair final result was achieved after ankylosis of the joint. In a case of spiral fracture of the tibia and fibula gangrene of the lower leg and foot occurred postoperatively necessitating amputation seven inches below the knee. The gangrene here was attributed to traumatic spasm of the popliteal artery and its collaterals. It is not believed that any of these complications could with fairness be attributed to the nerve block.

As regards the degree of anesthesia obtained, it was complete in all but five cases of the *Brachial* series. One case of the *Forearm* and wrist group, an eighteen-year old patient, was a poor subject for any anesthesia other than general, and despite heavy sedation he was uncooperative from the beginning. In the other four cases the

anesthesia began to wear off toward the end of the operation and skin closure was performed painlessly under novocaine field block. This unexpectedly early wearing off of the anesthesia occurred without explanation in these four cases, but the situation by that time lent itself well to control by a simple field block. Usually the anesthesia persists for much longer than one hour and in one case of the *Hand* group perfect anesthesia was present throughout the whole of a four and one-half hour operation.

In the *Sciatic* block cases, slight complaints were registered in 5 cases, all during the manipulation of the fractured bone ends into position. As soon as the manipulation had ceased there was no further complaint. This leads one to suspect that the cause of the complaints might well be the feeling of crepitus which, though unpleasant, is not painful, is felt by bone conduction and thus is not influenced by the block. It is probable that heavier sedation in these cases would have completely eliminated the slight complaints noted.

SUMMARY

A description is given of a successful technic for the use of novocaine block of the brachial plexus and the sciatic nerve in the regional anesthesia of the extremities, and the advantages of this form of anesthesia in emergency surgery are emphasized. A brief analysis is given of a series of thirty-one brachial plexus blocks and twenty-six sciatic nerve blocks used in this way.

PILONIDAL CYSTS

TREATMENT BY MARSUPIALIZATION OPERATION

CHARLES BUNCH, M.D.
On Active Surgical Staffs of Mercy, Presbyterian and Good Samaritan Hospitals
CHARLOTTE, NORTH CAROLINA

PILONIDAL cysts or cyst teratomas, as they are also called, are not unusual in private practice; however, they offered a major problem in military hospitals. There was the question as to whether they should be handled conservatively, or should be operated upon with the object of curing the condition, and just what type of operation should be done. The number of sick days had to be considered with the resultant temporary loss of this man to the service, together with possibility of recurrence of this condition following treatment.

Numerous young recruits would turn in for treatment before they had finished their preliminary training, others shortly thereafter. Many had sustained a slight injury that would result in a flare-up of these lesions. Some would date the beginning of their complaints to an injury received on the obstacle course or in a physical conditioning class. Later in their military career the injury was said to have been received while riding in a small boat in a rough sea, or while riding in some mechanized equipment over a rough terraine. Occasionally, an actual fall would be remembered. The frequent association of the complaint with mechanized equipment lead an author to refer to the condition as "Jeep Disease."[1]

The pathological condition was present and the trauma only made it apparent. The injury was only the exciting factor. Some few cases give no history of injury.

It is rather surprising that pilonidal cysts were not observed or at least recorded in the literature until 1867 when Warren[2] first mentioned them. However, he did not offer any ideas as to their origin. Nothing appeared in regard to this possible etiology until 1882 when Lannelongue's[3] article appeared which advanced the theory of this possible origin from ectodermal invaginations. Five years later Tourneaux and Herrmann[4] suggested that presisting vestiges of the neural canal might be their origin. Numerous articles have been written supporting one theory or the other. In 1934, Stone[5] wrote an article in which he suggested that they might arise from a vestigial structure analogus to Preen's gland of birds. Fox[6], in 1935, in his work in embryology, gave support to the invagination theory and he concluded that this took place between the third and fourth months from cells destined to form hair and glands. There is little to support Stone's[5] theory; and the belief that it is due to invagination of the ectodermal layer is concurred in by most authors, and seems to be the most plausible in the light of experience with newer methods of surgery. Pilonidal cysts are definitely congenital in origin.

The lesions are seen most often in the sacrococcygeal region as manifested on the skin by a small sinus or sinuses, which may or may not be in the mid-line. One can get little idea of the extent or direction of the cyst and its tracts usually from the external appearance. They are subject to periods of more or less acute inflammation with increased annoyance to the patient. Often several hairs can be seen protruding from the sinus. Actual abscess is sometimes formed. Often the chronic watery drainage from the area is the only reason for the patient to seek surgical relief. In the military hospitals abscess

formation is the more frequent reason for treatment.

The incidence of pilonidal cyst is fairly high. In the Navy there were more sick days from this condition in 1940 than for either hernia or syphilis.[10] Some pediatricians report that about one baby out of ten has this lesion present. It appears a little more common in the male than in the female.

The treatment can be divided into conservative and radical. The conservative is instituted with the idea not of curing the condition but only in getting the patient in condition to return to ordinary activity. This can be accomplished by simple institution of drainage usually by enlarging the sinus opening and application of wet heat. This was often done in the case of men in the armed services whose duties could not spare them for a long period.

More radical surgical procedures are necessary in effecting a cure. All operations can be included under three general headings: the closed type, the open type and the partially closed type. In order to do the closed type successfully it is necessary to excise all the cyst and its tracts, kill all dead space and be reasonably sure the operative field is dry and sterile, or nearly so. More often a little serum accumulates, plus a low grade infection and the entire area of operation opens up. I know of no way to be sure the area is sterile after dirty material has been excised. The closed method may get a patient well perhaps a little sooner than the other types of operation, but often there is disappointment; the wound opens up and there is a very long period of dressings.

Even wounds that for a time appear to heal after a lapse of several months may open and drain. Twenty-five per cent[7] of patients with closed operations who show later drainage is a conservative figure[8] in comparing reports, for according to some the figure is as high as 50 per cent.[1]

The operations are many and closures vary in the closed type. A preoperative régime has also been advocated with the object of clearing up infection and bed position postoperatively has been emphasized to take pressure off the skin area.

The semi-closed procedure is far safer in the greater percentage of cases than the closed. In some instances the closed eventually results in the semi-closed. It is the method that many of us have employed for many years. The cyst is removed, the edges brought loosely together and drainage instituted. In both of these methods the dissection is usually wide, sutures are uncomfortable and the patient bedridden, and many hypodermic for sedation are required.

By marsupilization many of these disadvantages are overcome. The wound is open, the patient is comfortable, rarely requiring any postoperative sedation, he is ambulatory and requires only a few days in the hospital. The operative area is not distorted by wide dissections nor is it tense from many sutures.

Buie[9] first mentions the marsupialization operation in 1937 but very few articles have appeared in the literature about it. He cites[1] the accomplishments by this method to be: (1) The size of the wound is reduced and there is no necessity for sacrificing much tissue; (2) after healing a complete and adequate amount of tissue is left to pad the sacrococcygeal region; (3) recurrence does not follow when the operation if first performed for the condition; (4) the duration of the period from operation to healing is satisfactory; (5) no unusual preoperative preparation is required; (6) patients are hospitalized for only a few days; (7) no strenuous management, such as "locking the bowels," complete rest, special diet, etc., is needed; and (8) postoperative discomfort is negligible.

The anesthetic of choice is a low spinal. Local might be used if we know for sure the cyst to be small, but there is no way to be sure.

The operation of marsupialization preserves a portion of the wall along with the base of the cyst and utilizes it in the

closure, the skin edges being sutured loosely to the wall. This membrane will possess all the histological structure of the skin itself even if it has been modified or destroyed by inflammation. An abundance of scar tissue has been replaced and it will become just as efficient in the process of healing.

The technic of marsupialization is accomplished by inserting a probe or groove director into the opening and splitting the skin along its course. Multiple sinuses are treated in like manner. The overhanging edges are cut away along with a portion of the lateral wall of the cyst or sinuses. The remaining cyst and sinus are cleaned of hair and other material with gauze. It is nearly always possible to fit the skin edges to the adjacent walls of the cyst and they can be sutured to the edges of the remaining cyst wall. A plain catgut suture in lock-stitch arrangement is best used. This also controls nicely any bleeding from the edges. We might think of this operation as "unroofing" the cyst.

Should any small tracts be missed at the time of operation it has been my experience that that particular portion will become inflamed and painful and with the use of a little local anesthetic this portion can be unroofed in the dressing room or office and no sutures are required. This remaining portion will be evident on the second or third day postoperatively.

Recently I have had a series of thirty-seven patients whom I operated upon by the marsupialization technic. The cysts ranged from very small to very large. In only two was a tract missed and they were handled as outlined above. Low spinal anesthesia was used in all. No postoperative sedation was required except for those who had very large cysts. Patients were allowed and encouraged to be up the following day and sitz-baths instituted. The average patient could have left the hospital the third postoperative day. The average wound was completely healed in three weeks. The largest wound was healed in six weeks. This patient, by the way, had been seen at one of the large hospitals in the west coast and had been told that the wound would take six months to heal. The cyst extended even down on the thigh. The patient who stayed in the hospital the longest in my service was one in whom primary closure was attempted only to open and drain. This wound required dressing for over three months and was slow in granulating. Had marsupialization been done, I believe he would have been healed in as many weeks.

Postoperative care, as mentioned, consists of sitz-baths, small dressings and the handling of excess granulations. The dressings are rarely very soiled.

Marsupialization offers the greatest comfort to the patient, requires fewer hospital days, and in my opinion, offers the greatest hope for cure. Although it is hard to judge the merits of a procedure from a small series of cases, this method of treatment has many distinct advantages and at the present time is the greatest advance in curing this condition.

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USE OF TRANSVERSUS ABDOMINIS IN REPAIR OF INDIRECT INGUINAL HERNIA

LIEUT. COL. EDWARD F. McLAUGHLIN
MEDICAL CORPS, ARMY OF THE UNITED STATES

THE two objectives of any hernial repair are to cure the immediate hernia and prevent a recurrence.

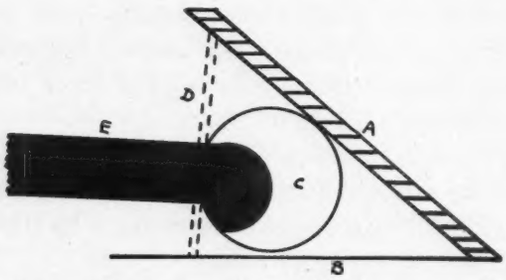

FIG. 1. The left inguinal region is represented diagrammatically. A represents the free margin of the aponeurosis of the transversus abdominis muscle; B represents the shelving margin of Poupart's ligament; C shows the internal abdominal ring, the margins of which are made up by the surrounding transversalis fascia; D indicates the deep epigastric vessel running beneath the transversalis fascia and bordering the inner margin of the ring. E indicates the cord structures emerging from the internal ring. The anatomical "v" described in the text is illustrated here with the internal abdominal ring appearing as a circle within the arms.

In young men with indirect hernias, the first of these objectives can often be accomplished by high ligation and resection of the hernial sac; the second by a proper repair of the dilated internal ring. The purpose of this article is to describe an operative technic for the accomplishment of this second objective, a technic in which the aponeurosis of the transversus abdominis is employed to reinforce the ring at the same time that its diameter is being reduced.

There are some points in anatomy, which are pertinent to this discussion and which should be reviewed before proceeding further. First, the "opening" in the transversalis fascia, known as the internal abdominal or internal inguinal ring is bordered above by the free margin of the transversus abdominis and below by the shelving margin of Poupart's ligament. It lies somewhat as a circle within the arms of a horizontal "v," the open end of which points toward the midline of the body. (Fig. 1). Secondly, the transversus abdominis is aponeurotic where it is in contact with the ring. Anson and McVay[1,2] and Morgan and Anson[3] found it to be aponeurotic at that point in 97 per cent of cadavers they dissected. It has been found so in all of the patients operated upon for indirect inguinal hernia at this hospital over a sixteen-month period where its anatomy has been particularly checked. The third point is that the transversus is on almost the same deep plane of the abdominal wall as the transversalis fascia and where it is aponeurotic it is especially close in its relation to that fascia. On the other hand, the internal oblique muscle is definitely on a more superficial plane and is not aponeurotic where it passes the internal ring. The fourth point is that the deep epigastric vessels running underneath the transversalis fascia border the inner lower edge of the ring, medial to the place where the cord structures emerge; therefore, a repair of the transversalis fascia medial to the emerging cord directed towards narrowing down the internal ring carries with it the danger of damaging these vessels and causing hemorrhage or infiltration of blood into the tissues, which would interfere with the healing process.

OPERATIVE TECHNIC

At operation, after the redundant sac has been severed and its closed stump dropped back through the dilated internal

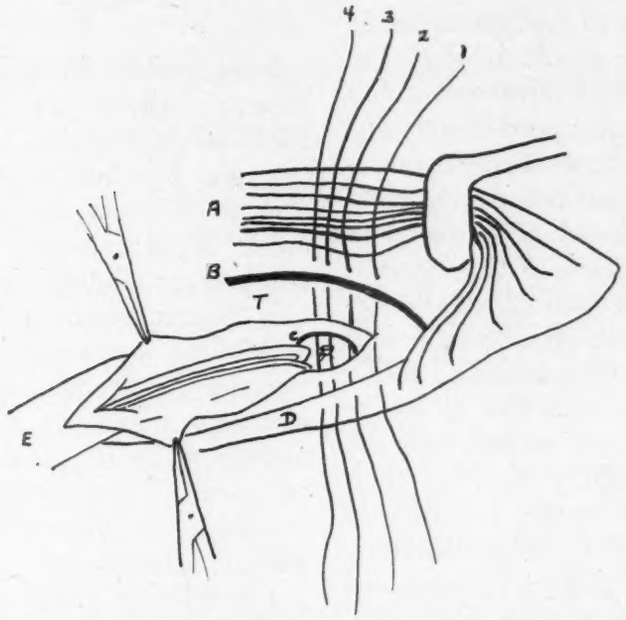

FIG. 2. This semi-diagrammatic drawing of the left inguinal region illustrates the placing of the sutures to effect the closure described in the text. A shows the retracted muscle fibers of the internal oblique. B is the aponeurosis of the transversus abdominis. The sutures represented by 1, 2, 3 and 4 enter the margin of the aponeurosis of the transversus abdominis and course under T, the transversalis fascia, to emerge through the upper edge of the internal abdominal ring C. Across the ring, they pierce the lower margin and continue under the transversalis fascia again to emerge through D, the shelving margin of Poupart's ligament. E represents the opened cord with the cord structures exposed. Within the circle of the internal abdominal ring, the tied off stump of a hernial sac is illustrated.

ring, repair plus reinforcement of the ring is accomplished in the following way: The shelving edge of the aponeurosis of the transversus abdominis is first identified and exposed. Good retraction of the internal oblique is necessary to accomplish this, and at times, very occasionally, in strongly muscled individuals, the arching edge of this muscle must be incised in order to displace it properly. Next, the dissection must be carried through cremaster muscle fibers and areolar tissue, which may veil the free edge of the aponeurosis of the deeper transversus abdominis muscle. After this edge has been identified and cleared, the shelving edge of Poupart's ligament is similarly exposed. When satisfactory exposure of both these structures has been obtained, one begins at the outermost part of the ring and places interrupted sutures. (Fig. 2.) Each suture passes through the following structures: (1) The edge of the aponeurosis of the transversus abdominis; (2) the transversalis fascia forming the upper margin of the internal abdominal ring; (3) the transversalis fascia forming the lower margin of the internal abdominal ring, and finally (4) the shelving margin of Poupart's ligament. The manner of placing these sutures may vary from case to case. The first bite may be taken from above or again from below or the suture may be started in through Poupart's ligament continued upward through its shelving margin and after the desired structures are included, out again through Poupart's ligament to be tied on the surface of that structure, the essential thing being that the four structures listed above be picked up by each stitch. After a sufficient number of such sutures are placed (two to

four usually), they are tied in the order of their placing and the result is that the internal ring is narrowed down till it fits snugly about the emerging cord structures. At the same time, the transversus aponeurosis and Poupart's ligament are approximated and form a closed door over the previously opened portion of the internal abdominal ring. These two fibrous structures are now even more intimately bound to the underlying transversalis fascia than they were before since this structure was included in the same sutures and has been brought up tightly against their under surface. It is also worthy to note that fascia has been sewed to fascia fulfilling what is held by some to be a requirement for good healing. Consider also the reinforcement which has been accomplished; it is immediate and intimate and not a plane or two removed from the place being reinforced. In this latter point, the present technic differs from the classical technic of Ferguson, wherein the more superficial and more muscular internal oblique is used to reinforce the repaired internal ring. The potential or real "dead space" left between the repaired ring and the transposed internal oblique in the Ferguson repair does not remain after the operation herein described has been completed.

SUMMARY

Four points in the anatomy of the inguinal region are brought out; first, the close relationship between the internal ring and the free edge of the transversus abdominis above and with Poupart's ligament below; second, the fact that the transversus abdominis is aponeurotic at this point; third, that the transversus abdominis aponeurosis and the transversalis fascia are almost on planes of identical depth in the makeup of the abdominal wall; fourth, the dangerous position of the deep epigastric vessels medial to the inner margin of the internal abdominal ring.

Considering these anatomical facts, a technic has been devised in which the aponeurosis of the transversus abdominis is sewed down to the shelving margin of Poupart's ligament, the ring margins being included in the sutures for the closure of the dilated internal ring found in association with indirect inguinal hernias. The intimate reinforcement given by this technic, and the lack of "dead space" following its use is emphasized.

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ULTRAVIOLET BLOOD IRRADIATION IN BILIARY DISEASE

KNOTT METHOD

R. C. OLNEY, M.D.
LINCOLN, NEBRASKA

ONE of the most frequent and perplexing problems confronting the average physician and surgeon, whether in general practice, internal medicine or surgery, is disease of the biliary tract. Drainage is of primary importance in the resolution of all inflammatory and infectious diseases, and this is equally important in disease of the biliary tract. As long as we have free and proper drainage of the biliary tree, we do not have biliary disease. We are so accustomed to speaking of gallbladder disease that we are prone to forget that the obstruction of the biliary ducts due to swelling and inflammatory reaction, obstructing drainage and function of the gallbladder is the primary cause of gallbladder disease. So, in considering gallbladder disease, we must first emphasize that this is a disease of the biliary tract in which the most important part of this disturbance is obstruction to free bile drainage.

In using ultraviolet blood irradiation therapy (Knott method) in acute and chronic inflammatory diseases, we early noticed the marked and rapid reduction in swelling, pressure and inflammation; this was so marked that we began treating non-malignant disease of the biliary tract in the hope that this marked reduction in swelling, inflammation and pressure would allow biliary drainage and facilitate recovery of these patients. To date, we have treated 383 patients with all types of non-malignant biliary disease in which the results have been so interesting that we believe they are worth reporting. These cases have been classified as follows: (1) Acute, very severe, patients almost moribund, three; (2) acute, very severe, five; (3) chronic, without stones, 264; (4) chronic, with stones, fifty-six; (5) chronic cholangitis and hepatitis, gallbladder previously removed, fifty-five.

Acute Very Severe—Patients Moribund. Two patients were seen in extremely critical condition. One patient was seventy-eight years of age; the other, eighty years of age. The white blood count was 30,000 and 35,000, respectively; both were semicomatous, markedly jaundiced, with rapid pulse and a large, rigid, tender mass in the upper right quadrant indicative of definitely acute, severe cholecystitis and biliary disease. Both patients had been under treatment for more than a month without improvement and were sent to the hospital to die. With ultraviolet blood irradiation therapy, both of these patients responded promptly and rapidly. In three and four days, respectively, both were taking nourishment, the swelling and mass in the upper right quadrant subsided markedly, the white count came down and the general condition improved rapidly. Both were discharged from the hospital after fourteen and eighteen days, respectively, without surgery. Both patients have been followed for more than a year; neither has had a recurrence and both have been feeling very well. Functional gallbladder *x*-rays several months later revealed moderate concentration of dye in the gallbladder with fairly good function.

One other case was almost identical with these two except that this patient had a decompensated heart along with biliary findings and was in a moribund condition. Her progress after ultraviolet blood irradiation therapy was slower, but there was very marked improvement. She has now been observed for more than a

year and is up and about in a very normal condition for a person of her age.

Acute Severe Cases. Five patients were seen with acute, severe cholecystitis with increased leukocyte count, temperature, mass in the upper right quadrant very tender, and varying degrees of jaundice. All of these patients showed marked relief from ultraviolet blood irradiation therapy; relief from pain, swelling, and tenderness was very prompt within twenty-four to forty-eight hours; the temperature went down rapidly and the swelling reduced markedly in two to three days.

Four of these patients have not been operated on and have had complete relief from symptoms for a period of from four months to one-and-a-half years.

The fifth patient proved to have stones in the gallbladder and was subsequently operated on with complete relief of symptoms. In this case, the patient's operative condition was made very safe and easy by the preoperative ultraviolet blood irradiation therapy, and when operated on the patient was in good surgical condition.

Biliary Disease, Chronic, without Stones. This is a large series of cases of chronic biliary disease without stones. All of these cases were typical cases of chronic biliary disease in which the history and physical findings were typical. Careful study of each case was made to determine the diagnosis; all the patients had functional gallbladder *x*-rays, gastrointestinal *x*-rays, gastric analysis, serology, and any other examination believed necessary to determine the diagnosis and differential diagnosis. These patients had all been under treatment for a period of time, varying from months to years, some by others and some by myself. All of them had typical symptoms of recurrent attacks of jaundice of varying degrees, indigestion after meals, excessive gas, recurrent attacks of pain in the upper right quadrant and epigastrium, and many had pain referred to the subscapular region on the right side. All except twelve of this group received marked relief of symptoms and have been observed for a period of four months to one and a half years following treatment. The relief in this group of patients has been very encouraging, and these patients have been very grateful for their relief. Dietary and medical management were continued in these cases following and along with ultraviolet blood irradiation therapy. The important point is that the ultraviolet blood irradiation therapy seemed to reduce swelling and congestion in the biliary tract, promoting bile drainage, and was just another important step in the treatment of these patients. None of these patients has been operated on.

There are three interesting cases, however, in which the gallbladder had previously been drained and not removed; two patients had stones, one did not have stones. None of these patients had been operated on by me. All had gone for several years with marked recurrence of their cholecystitis. All three have obtained practically complete relief of symptoms and functional gallbladder *x*-rays show quite normally functioning gallbladders, which previous to treatment had shown no shadow or only a slight shadow.

Chronic with Stones. This is a group of chronic biliary disease with cholelithiasis in which forty-eight have been operated on. These patients were all prepared for surgery by preoperative ultraviolet blood irradiation therapy along with all usual preparation of these cases. It is important to emphasize that these patients were relieved of symptoms markedly by ultraviolet blood irradiation therapy and that their surgery was made much easier and safer. Comparing this group of surgical cases with similar patients operated upon over many years of time, I have been greatly impressed with the difference; postoperative ileus, pain and distention were much less and convalescence was markedly smoother than previously.

Chronic Cholangitis and Hepatitis, Gallbladder Previously Removed. This is a very interesting group of fifty-five cases

of biliary disease in which the gallbladder had previously been removed and who continued to have recurrent attacks of symptoms. These patients continued to have recurrent attacks of jaundice of varying degrees, indigestion after meals, gas, pain in the upper right quadrant and epigastrium, and many with pain in the subscapular region on the right side.

Forty-six of these were greatly relieved of symptoms and have been observed for from four months to one and a half years and have remained free of symptoms during this time; the others obtained moderate relief, but some of these had not continued treatment as suggested. Dietary and medical management were continued as previously in these cases. On all cases of chronic biliary disease, complete studies were made to determine the diagnosis and differential diagnosis: *x*-ray studies of the gastrointestinal tract, gastric analysis, blood study, and whatever other information seemed pertinent to prove the diagnosis in these cases.

PREOPERATIVE CONSIDERATIONS

Forty-eight cases were prepared for surgery by preoperative ultraviolet blood irradiation therapy; these were all cases in which the surgical attack was considered hazardous or serious, some extremely hazardous. In using this preoperative preparation, there has been very little postoperative ileus, distention and similar disturbances; very few have had to have intranasal stomach drainage, and the amount of intravenous fluids has been about half the amount used previously. These patients were able to take fluid by mouth very early, were able to turn and exercise without much difficulty and their feeling of well being was very marked. Postoperative complications, such as pulmonary involvement and phlebitis, have been very few. These observations have been carefully compared with similar patients operated upon over many years' time.

Two patients in this group died; both had gangrenous gallbladders. Both were elderly people and their condition was practically hopeless.

POSTOPERATIVE CONSIDERATIONS

In cases requiring prompt and immediate surgery in which peritonitis is extensive and the patient is in a critical condition, ultraviolet blood irradiation therapy is extremely valuable. Treatment can be given very soon after surgery. In almost all cases, there is marked relief of cyanosis, distention, ileus and marked improvement in the patient's general condition. Intranasal stomach drainage is used very little and patients improve much more rapidly than a similar group operated upon over many years of time before. We believe definitely that recovery in many of these cases was due to the help received from ultraviolet blood irradiation therapy.

SUMMARY AND CONCLUSIONS

Ultraviolet blood irradiation has now been used for one and a half years, and after this time of observation some very important clinical observations stand out:

1. After treatment with ultraviolet blood irradiation, there seems to be a prompt and marked reduction of swelling and pressure, which seems to be particularly important in the treatment of diseases of the biliary tract.

2. In severe peritonitis with postoperative ileus, this is by far the most effective treatment I have ever used. There is marked increase in the tone of the intestinal tract, relief of severe reverse peristalsis, cyanosis and such symptoms to a marked degree. Extremely ill patients respond to this treatment that do not respond to any other.

3. In preoperative preparation of serious surgical cases, it is of great value. Patients withstand serious surgery with fewer complications, have less pain, require less intravenous fluids and recovery is hastened; pulmonary complications and phlebitis are markedly reduced and, when they occur, respond markedly to ultraviolet blood irradiation.

PHYSIOLOGY OF THE NOSE AND ITS RELATION TO PLASTIC SURGERY*

EDWARD S. LAMONT, M.D.
HOLLYWOOD, CALIFORNIA

THE primary purpose of the rhinologist is to restore a disturbed nose to normal function. In that "normal" presents such a wide latitude, the end result will be dependent on the material presented and the cleverness of the clinician.

A B

FIG. 1. A, old fracture of the nose, resulting in external deformity and internal dislocation of the septum. At the time of the nasal reconstruction the septum was relocated with an Asch forceps; B, following surgery and restoration of normal breathing space.

Primarily, the nose functions as an air passage. The mucous membrane, the cilia, glands, turbinates and the sinuses have individual functions all coincidental with the passage of air. Nasal blockage may cause drying, interfere with drainage and result in side chain reactions that will serve to upset the physiology of the whole nasal chamber. Once the circle is begun and especially if it becomes chronic, it may require more than merely eradication of the original causative factor to overcome the pathological condition.

Allergy, vasomotor rhinitis, trauma, tumors, congenital defects, either singly or in combination, may serve to disturb the individual's normal physiology. Conservative procedures should be first attempted before more radical surgical effort

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A B

FIG. 2. A, congenital deformity. The long upper lateral cartilages in conjunction with a dropped tip created a ball-valve action causing bilateral intermittent blockage of breathing; B, reconstruction of the nose with internal adjustment resulted in both an improved cosmetic and physiologic picture.

is instituted. When surgery is the choice, the operator should possess a preconceived picture of the end result he hopes to obtain. Unfortunately, bulldozing a pathway within the nose with the scapel is not the answer. The aperture created by surgery must be physiologically correct or the patient may be worse. Function must be the guiding impetus of all incisions.

The pathway followed by inspired and expired air and the physiologic effects of pathologic change in the air passages have been well discussed by Proetz.[15] With a knowledge of these concepts, the clinician must attempt to return the tissues to as near normal function as possible.

A bulging turbinate blocking the airway should be investigated for the presence of allergy or infection in the sinuses. If these measures fail, cauterization, electrocoagulation, submucous resection of the turbinates or injection may be employed.[6]

When the preceding deformity is present in conjunction with a deviated septum blocking the nasal passage, or a flattened tip with depressed upper and lower lateral cartilages, the investigation becomes more complicated.

THE AIRWAY

Inspired air gathers moisture as it passes over the turbinates and warms close to body temperature. In performing this duty, the nose contributes almost a liter of water in a day and a night. This round the clock function of the nose requires about seventy calories.

Due to electrostatic charges within the nose and the moisture present, the passageway is self-cleansing of particular matter. A constricted opening, wide scars due to incisions, senecia or spurs, all may act to create eddy currents and upset the normal cleansing processes that occur within the nasal vault.

A B

FIG. 3. A, dislocated and fractured septum; complete curvature of the septum toward the right and total blockage of breathing. The early fracture had resulted in deformity which required cosmetic correction, as well as restoration of the physiologic air passage. B, following rhino-osteoplasty and reconstruction of the septum as depicted in the drawings.

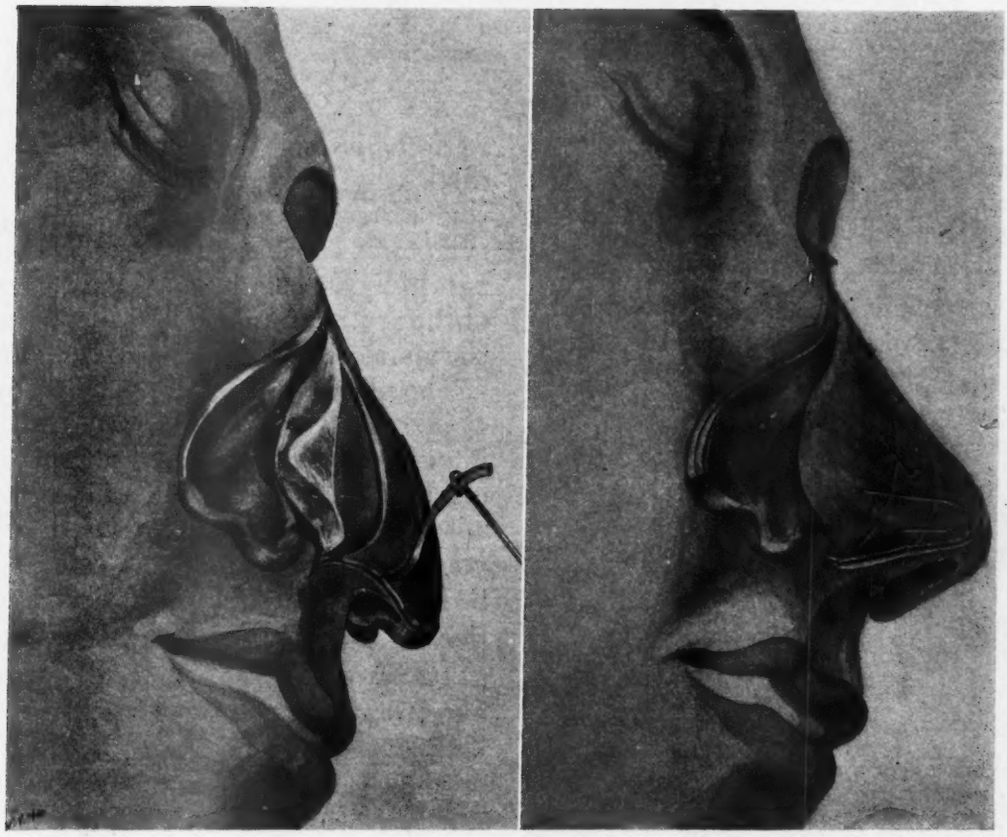
If the disturbance to the tissue within the nose be of major consequence, the mucosa, the cilia and the glands cannot perform their function, so that drying occurs. Over a long period of time, excessive drying will incapacitate the cilia, causing a change in the epithelial nature from ciliated columnar to squamous cells. Such a metamorphosis results in crusting and discomfort to the patient.

The narrowest portion of the nasal passage exists approximately 1½ cm. posterior to the alar rim. Its boundaries are formed by the septum medially, the fold of tissue between the upper and lower lateral cartilages above and the floor of the maxilla below. Interference with this opening may result in a condition ranging from complete obstruction to partial closure with a ball-valve action.

The longest incision in a rhino-osteoplastic operation lies in this area. It com-

FIG. 4. Author's procedures in reconstructing a twisted anterior septum. A, in such cases a submucous resection will serve no purpose and is actually contraindicated. The twist involves cartilaginous septum which includes the upper lateral cartilages. The latter are severed from the septum intranasally and after the required amount is resected the septum is reconstructed. B, the nose has been diagrammatically bisected to demonstrate the intranasal operation. Mucous membrane on the convex side is dissected away from the cartilaginous septum. A modified hyperbolic incision through the cartilage to the opposite mucous membrane is made from the dorsum of the nose downward to the nasal spine. Approximately a millimeter anteriorly, a similar parallel incision is made allowing the curved sliver of cartilage to be resected. Should the convexity be acute a similar procedure is carried out more anteriorly. C, the mucous membrane is then laid back against the cartilage and several staggered sutures (No. ooo black silk) are taken through the mucous membrane, cartilage and the opposite mucous membrane. The curvature of the septum is thus corrected and normal physiologic function of the nose restored.

A



B C

FIG. 4.
For caption see page 240.

A B

FIG. 5. A, flattened nose resulting from a complete removal of the septum many years ago; B, restorative surgery necessitated reconstruction of the nose and a cartilage plate grafted between the empty mucous membrane flaps, extending within the columella from the tip to the nasal spine and backward to the vomer.

mences in the lowermost lateral portion between the upper and lower lateral cartilages, is brought forward and upward to the tip of the septum, then curved and brought downward to separate the septum from the columella. Unless the surgeon is always cognizant of the physiologic and mechanical importance of this aperature, an annular scar may occur with resulting obstruction.

If the scars within the nose be wide or overriding, they will serve as dams against the normal ciliary pathway. Not only will the effected side of the nose suffer, but an asymmetry of nasal ventilation will occur with the opposite side taking over most of the burden, thus resulting in excessive drying of the mucosal walls.

A scar contracture of this hiatus causes a stream of air to be inspired through a small opening under increased pressure which results in eddy currents that upset the normal humidification and cleansing processes of the nose.

CLINICAL FINDINGS

In reviewing the last 500 consecutive cases who have presented themselves for rhino-osteoplasty, 22 per cent present symptoms and/or a history of partial nasal blockage. Allergic rhinitis, deviation of the septum or a combination of both are the main causative factors in that order.

The plastic surgeon must be prepared to evaluate physiologic disturbance to the internal nasal passage. A patient with an external nasal deformity who also suffers with nasal blockage, "sinus headache," post-nasal drip, "frequent colds," should be handled as a complete entity. A recognition of physiologic disturbance and consultation with an otolaryngologist prior to nasal reconstruction will result in a much happier patient and surgeon.

The discovery of a guilty allergen, the removal of polyps or spurs, or a thorough submucous resection when required may aid in restoring the normal physiology.[1–4]

A B

Fig. 6. A, fracture of the nose in conjunction with congenital deformity; B, the cosmetic and physiologic improvement stimulated the patient to have dermatologic consultation for eradication of a long standing case of acne.

Often the rhino-osteoplasty with a straightening of the septum and reconstruction of the upper and lower lateral cartilages may do much to overcome mechanical difficulties of the airway.

The surgeon must attempt to judge the normal for each individual patient. When disease is chronic, when tissue has become thickened and when fibrosis has invaded normal ciliated areas, the surgeon must employ those procedures with occasional modifications that will restore the nasal passage to a functional airway without making the patient worse. Such procedures that may be applicable in one case may be entirely wrong in another, and the surgeon's guide should be a plan with his eye focused on the end result.[18]

THE SEPTUM

We have previously discussed the importance of a thorough submucous resection when required.[10] Should the deviation be associated with a nasal deformity, the former may be accomplished three or four months prior to the latter. In occasional cases, the submucous resection may be done afterward; it is no longer our policy to do both operations together.

Should the septum be dislocated from the vomer groove, it may be replaced with an Asch forceps at the time of rhino-osteoplasty.[9] This is accomplished with little difficulty after the septum has been detached from its anterior and inferior moorings. (Figs. 1 to 7.)

Due to previous injury, the end of the septum may terminate in an abrupt curve. Such a defect cannot be overcome by a submucous resection and may cause a cosmetic deformity of the nose, as well as mechanical blockage to the airway. Several methods of conquering such a problem have been suggested.[3,13,16,17] After deflecting the mucous membrane on the convex curve of the deformed septum, a thin

A B

FIG. 7. A, congenital deformity associated with an early fracture: dropped tip, long upper lateral cartilages and dislocated septum had interfered with normal ventilation; B, six weeks following rhino-osteoplasty and relocation of the septum.

hyperbolic sliver of cartilage, extending from the dorsum down to the nasal spine, is resected. Where required, a second piece of cartilage may be removed more anteriorly. The mucous membrane is replaced and staggered sutures taken between the separated sections of cartilaginous septum. (Figs. 3 and 4.)

UPPER LATERAL CARTILAGES

In cases with a flattened cartilaginous bridge, or a large nose with excessively long upper lateral cartilages, the nasal passage may be partially blocked, producing a ball-valve action with inspiration. The least amount of mucus, which is more apt to be present in these cases, due to lack of areation, will further exaggerate the picture. Such patients present an effort at inspiration, the alar rims flare outward, while the alar grooves deepen appreciably. (Figs. 2 to 6.)

Such deformities may be corrected if they are properly evaluated. A saddle deformity of the lower dorsum may require a cartilage graft or the upper lateral cartilages themselves may be so fashioned as to overcome the defect.[11] When the tip is overhanging, the necessary amount of cartilaginous septum and upper lateral cartilages are resected.

Meticulous care should be entertained in suturing the lining of the upper lateral cartilage to the lower lateral cartilage on both sides. A more exact approximation results in less granulation tissue and a finer scar. The latter is especially important from a physiologic standpoint to avoid any barriers to ciliary pathways. Careful suturing will aid in avoiding the ball-valve action of the lateral walls.

LOWER LATERAL CARTILAGES

The surgical procedure in reconstructing the nasal tip that results in a pleasing contour without physiologic interference to the nasal vestibule has previously been described.[6] Pinching or collapse of the lower lateral cartilages may be prevented if these members are carefully

undermined and allowed to slide to their new position. Careful suturing of the lining will aid both in the cosmetic and physiologic reconstruction.

The columella, consisting of the medial crura of the lower lateral cartilages may serve as a causative factor in airway blockage. This is especially true in cases of fracture and septal dislocation. In conjunction with septal relocation, reconstruction of the medial crura of the lower lateral cartilages is often necessary.

A cartilage graft within the columella or at the columellar-philtrum juncture may be demanded. Upper or lower lateral cartilages, septal cartilage, autogenous rib cartilage or necrocartilage may be employed.[5,8,14] Time should be allotted to sculpture the cartilage so as to obtain a more pleasing cosmetic result. (Fig. 5.)

Rather than utilize a single "orthopedic" suture, we realign the septum to the columella with a series of sutures on either side. Again, it is our belief that the time necessary for such a procedure is balanced by the advantages gained.

NASAL LINING

Though this paper does not primarily deal with loss of nasal tissue, the problem is often presented. When nasal lining is required in conjunction with a compound pedicle, we usually employ a split skin graft.[2,7] The forehead flap, the sickle flap, a pedicle from the arm or other procedures may be utilized as required.[12]

Atresia of the nostril will necessitate excision of scar tissue and the prepared cavity made sufficiently large to compensate for contracture. For reconstruction of the nasal lining, either oral mucous membrane or a split skin graft may be utilized.

The graft may be sewn or cemented around a dental stent that has been modelled to fit the defect.[19] The stent is allowed to remain in place eight to ten days. After its removal, the area is cleansed and the stent reapplied. Following this, a hollow obdurator is used intermittently for many weeks to prevent contracture. The restoration of an airway will aid the nasal vault to carry on its physiologic duties.

SUMMARY

1. The plastic surgeon must evaluate and correct physiologic defects within the nose.

2. The septum, the turbinates, the cartilages of the nose and the nasal lining must be considered as a physiologic entity.

3. Cartilage grafts, bone grafts, mucous membrane or split skin grafts may be utilized when required.

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HEMOLYTIC STREPTOCOCCUS IN WOUNDS OF RABBITS*

ACTION OF 5-NITRO-2-FURALDEHYDE SEMICARBAZONE

ERWIN NETER, M.D. AND THOMAS G. LAMBERTI, M.D.

Assistant Professor of Bacteriology,
University of Buffalo

BUFFALO, NEW YORK

IN a series of publications[1,2,3] the effects of various disinfectants and chemotherapeutic agents upon hemolytic streptococcus in artificial wounds of rabbits were reported. It was shown that the antibiotics, penicillin, tyrothricin, and streptothricin, exerted definite antistreptococcal activity *in vivo*. Sulfonamides proved to be largely ineffective. Recently, Dodd and Stillman[4] reported on the bacteriostatic activity of some simple furan derivatives. These authors found that certain nitro-furan compounds inhibited *in vitro* the growth of bacteria or exerted bactericidal effects, even when the drugs were used in relatively low concentration. Of the compounds studied, 5-nitro-2-furaldehyde semicarbazone proved to be most promising for possible therapeutic application. It seemed of interest, therefore, to determine whether or not this drug is also effective against hemolytic streptococcus in artificial wounds of rabbits. The results of these experiments are embodied in the ensuing report.

Material and Methods. The technic employed has been described in detail elsewhere.[1] Medium-sized rabbits were used. Artificial wounds, measuring approximately 1 cm. in diameter, were infected with a twenty-four-hour infusion broth culture of a group A beta hemolytic streptococcus. This strain proved to be sulfonamide-susceptible *in vitro*. The drug, 5-nitro-2-furaldehyde semicarbazone, was applied to the wounds either in powdered form (1 and 10 mg.) or in a washable base in a concentration of 1:500. The formula of the base is as follows:

	Per Cent
Carbowax 1500	55
Carbowax 4000	20
Propylend glycol	25

The effects of these drugs upon the hemolytic streptococcus in the wound was determined by taking cultures of the wounds after treatment for various periods of time. Material from the wounds was seeded on 5 per cent human blood agar. The agar plates were then incubated for seventy-two hours at 37°C. and the approximate number of colonies of hemolytic streptococci was recorded.

Results. In all, 146 individual wounds infected with the hemolytic streptococcus were treated with 5-nitro-2-furaldehyde semicarbazone or served as untreated controls. The results were as follows: (1) In thirty-three out of thirty-four control wounds many hemolytic streptococci persisted during the observation period ranging from twenty-four to seventy-two hours. (2) In contrast, treatment of the wounds with the furan compound reduced the number of hemolytic streptococci in seventy-two out of 112 wounds. Ten mg. of the drug in powdered form was effective in thirty-one out of forty-one experiments and 1 mg. in eleven out of nineteen experiments. Furan, in amounts of 0.2 mg. in washable base, caused a reduction in the number of hemolytic streptococci in thirty out of fifty-two infected wounds. That prolonged treatment yielded better results is evidenced by the following ob-

* From the University of Buffalo and the Laboratory of Bacteriology, Children's Hospital, Buffalo, New York.

servation: Reduction in the number of hemolytic streptococci after treatment for twenty-four hours occurred in only eight out of twenty-two experiments and after therapy for seventy-two hours in ten out of fourteen experiments.

Comment. It is well known that the *in vivo* activity of disinfectants does not always parallel that exerted under *in vitro* conditions. It is noteworthy, therefore, that the bacteriostatic activity of 5-nitro-2-furaldehyde semicarbazone demonstrated *in vitro* by Dodd and Stillman could be established also in experimentally infected wounds. It is worthy of note that, as shown previously, sulfanilamide and sulfathiazole, even in amounts of 100 mg. applied for twenty-four to forty-eight hours, failed to exert any significant effect under like experimental conditions. On the other hand, the antibiotics penicillin, tyrothricin and streptothricin caused a reduction in the number of streptococci in such infected wounds.

The selection of any antimicrobial agent to be used in the treatment of localized or systemic infections of man depends upon several factors, in particular upon its *in vivo* activity toward the respective microorganisms and its toxicity. That 5-nitro-2-furaldehyde semicarbazone is of limited toxicity and is effective in infections of man has been shown by Dodd, Hartmann and Ward[5] as well as by Snyder, Kiehn, and Christophersen.[6] Further experiments and clinical observations are necessary to determine the merits of this compound as an antimicrobial agent for the treatment of localized and systemic infections of man.

SUMMARY

The compound,* 5-nitro-2-furaldehyde semicarbazone, in amounts of 0.2 mg. to 10 mg. (in powdered form and in a washable base) reduced the number of group A beta hemolytic streptococci in artificially infected wounds of rabbits in a substantial number of experiments.

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NEW OPERATION FOR DISLOCATED SEPTAL CARTILAGE*

REUBEN KAYSER, M.D.
Adjunct Otolaryngologist, Isreal Zion Hospital
BROOKLYN, NEW YORK

THE otolaryngologist is frequently confronted with the problem of correcting a nasal obstruction due to a septum and with an external nasal deformity, the same operative procedure is followed. This is so because the deformities

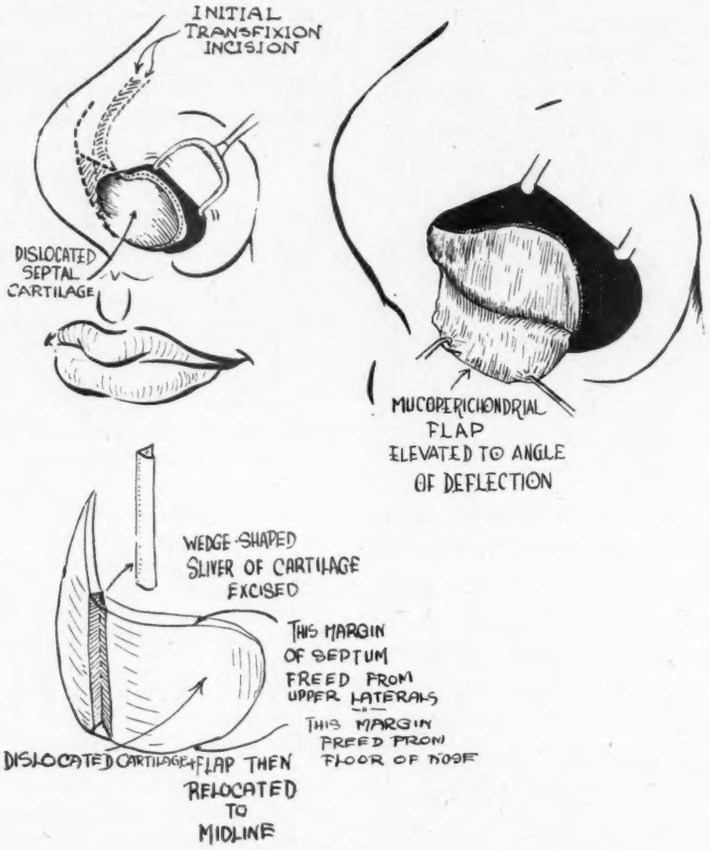
INITIAL TRANSFIXION INCISION
DISLOCATED SEPTAL CARTILAGE
MUCOPERICHONDRIAL FLAP ELEVATED TO ANGLE OF DEFLECTION
WEDGE-SHAPED SLIVER OF CARTILAGE EXCISED
THIS MARGIN OF SEPTUM FREED FROM UPPER LATERALS
THIS MARGIN FREED FROM FLOOR OF NOSE
DISLOCATED CARTILAGE + FLAP THEN RELOCATED TO MIDLINE

FIG. 1.

dislocated septal cartilage. This dislocation may be the only abnormality present, but it may be associated with an external nasal deformity. Usually the dislocated septal cartilage is just the anterior part of a generally deviated septum.

Regardless of whether the dislocated septal cartilage exists alone or whether it is associated with deflections of the bony are merely varying degrees of derangement of the anatomical structures. The amount of distortion of cartilage and bone and the scarring and contracture of the surrounding soft parts regulate the degree to which the operative procedure is carried out. In this operation one secures permanently the septum in its mid-line position.

* Part of paper read before the American Otorhinologic Society for the Advancement for Plastic and Reconstructive Surgery, Inc., under the title "Rhinoplasty and Nasal Rhysiology" on November 11, 1944. Also read before the Section on Laryngology, Rhinology and Otology of the Medical Society of the County of Kings and Academy of Medicine of Brooklyn, on April 11, 1945, as part of paper titled "Rhinoplasty and the Submucous Resection as Aids Towards Improving Nasal Physiology with Presentation of a New Technic for Correcting the Dislocated and Obstructing Septal Cartilage Associated with and without External Nasal Deformity."

Before proceeding to the new operation here advocated, I wish to correct some erroneous concepts about the nasal septum. We are all familiar with the teaching that in performing a submucous resection one must leave intact enough of the septum to assure adequate support of the so-called dorsum of the nose. Occasionally, it is just this residual supporting segment of the septum which is the obstruction we are now seeking to correct. My personal studies in this direction have led me to the conclusion that the primary function of the septum is to help direct air currents within the nose. Contrary to the accepted belief, in my opinion, the septum contributes little support, if any, to the nasal bones and the upper lateral cartilages. It has only one supporting value of importance, and that is to the area of the tip. A saddle deformity may occur after some submucous resections. This results when the upper lateral cartilages end short of the distal end of the septum. In such exceptional cases the operator must preserve a prow-like projection of the septal cartilage to give support.

MARKEDLY DISLOCATED AND DISTORTED SEPTAL CARTILAGE ENTIRELY TO BE EXCISED
MUCOPERICHONDRIAL FLAP BOUND DOWN BY ADHESIONS TO BE ELEVATED FROM FLOOR OF NOSE AND SEPTUM EXTENSIVELY ENOUGH TO GIVE ADEQUATE SLACK
POSTERIOR INCISION AND SEPARATION OF MEDIAL CRURA TO PERMIT IMPLANTATION OF CARTILAGINOUS STRUT

FIG. 2.

NEW OPERATIVE PROCEDURE

After adequate local anaesthesia, a rhinoplastic transfixion incision is made. (Fig. 1A.) When the dislocated cartilage is just displaced from the interspinous attachment and from the vomerine groove, and when its accompanying mucoperichondrium is not scarred and bound down in its abnormal position, and when the columella is still in the mid-line and the nasal frame-work is not deformed, the next procedure is simple. The deflected cartilage is exposed on one surface by elevating the mucoperichondrial flap, ventrally as far as its attachment to the upper lateral cartilages, caudad to the floor of the nose and posteriorly to the angle of deflection. (Fig. 1B.) If the cartilage is displaced transversely beyond the mid-line from one nostril to the other, it is then exposed beyond the angle of deflection and followed backward until undeflected septum is reached. The exposed cartilage is then cut free, above from its attachment to the upper lateral cartilages, below from the floor of the nose, and behind from the remaining septum. As soon as the deflected cartilage is liberated from its attachments, it should be easily relocated into the mid-line and fixed into a bed prepared at the cephalad aspect of the columella. It may also be necessary to correct simple angulations or bowings within the fragment of deflected cartilage by cross hatching or removing wedge-shaped slivers of cartilage. (Fig. 1C.) Except for the rhinoplastic transfixion incision, the procedure presented so far has been that outlined by Safian* as the "Swinging Door Operation," more commonly known as the Metzenbaum technic.

If the septal cartilage is dislocated and crushed as well, and if it exists with nasal deformity, one still begins with the rhinoplastic transfixion incision. Next the nasal hump is removed and the upper lateral cartilages are completely freed from their

* Safian, Joseph. Corrective Rhinoplastic Surgery. Pp. 178–179.

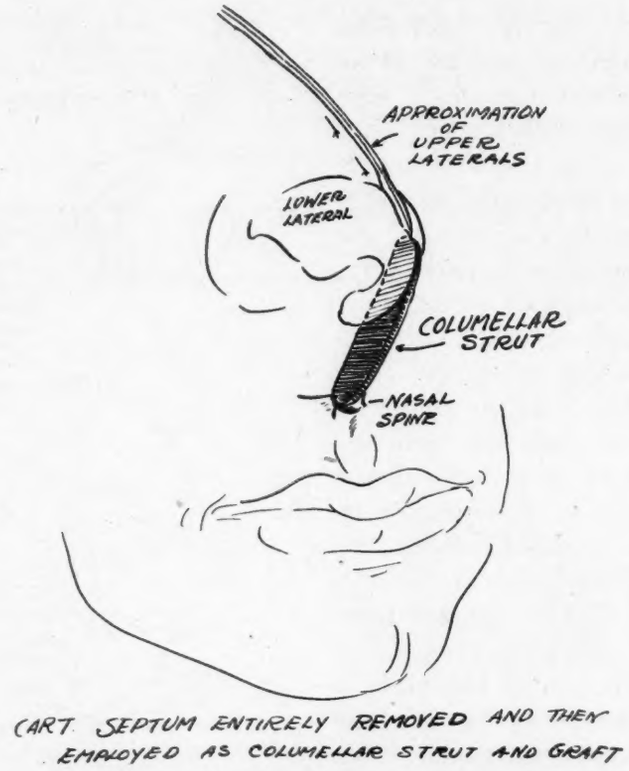
APPROXIMATION OF UPPER LATERALS
LOWER LATERAL
COLUMELLAR STRUT
NASAL SPINE
CART. SEPTUM ENTIRELY REMOVED AND THEN EMPLOYED AS COLUMELLAR STRUT AND GRAFT

Fig. 3.

A B

Fig. 4. A, dislocation of septal cartilage beyond alar rim; B, after correction.

septal attachments. The cartilage of the septum can thus be approached both from its anterior and its caudal aspects. The technic is then to expose one surface of the septal cartilage until undeflected septum is reached and then free this exposed cartilage at all its margins. One usually finds that as soon as the fragment of cartilage is liberated from its marginal attachments it is drawn into an unnatural position beyond the mid-line because of the scar contracture of the mucoperichondrium attached to the other surface of this cartilage fragment. It is in this instance that it is necessary to *excise the deflected cartilage entirely*. The excised piece of cartilage is placed aside, later to be used as a columellar strut and septal graft. The mucoperichondrial flaps are undermined both from the remaining septum and *from the floor of the nose* until enough slack is created (Fig. 2A) to permit the flaps to stay in the mid-line when complete healing has occurred. The ceph-

FIG. 5. A and B, right and left profiles before corrections; C and D, right and left profiles after operation.

alad aspect of the columella is vertically incised separating the two medial crura from each other. An adequate strip of cartilage is placed into the columella to act as a strut. (Fig. 2B.) If there is not an adequate piece available from the septal cartilage fragment previously excised, a piece of pickled septal cartilage, or better yet, pickled rib cartilage can be employed. The remainder of the septal cartilaginous fragment can then be placed between the two mucoperichondrial flaps and left there as a cartilage graft. The upper lateral cartilages including this graft are then sewn together, using fine chromic mattress sutures. (Fig. 3.) The caudal edges of the mucoperichondrial flaps are then approximated to the membranous columella by interrupted silk sutures. To insure midline healing, vaseline packs or rubber tubes should be left in each nostril and nasal cavity for as long as may be necessary, that is until satisfactory fixation of the cartilage grafts has occurred. (Figs. 4 and 5.)

SUMMARY

An operative procedure has been outlined for repairing any type of septal cartilage dislocation or deformity. This is based upon the principle that one may, with safety, entirely excise a deformed septal cartilage and still support the nose by the use of the upper lateral cartilages and a columellar cartilaginous strut.

A METHOD OF PELVIC MEASUREMENT

DAVID I. SOLOMON, M.D.
NEW YORK, NEW YORK

THE purpose of this paper is to simplify pelvic measurement. The principle is as follows: A metal ball of known diameter is inserted into the rectum. Lateral and anteroposterior *x*-rays are taken. The enlargement of the pelvis on the *x*-ray is accurately mirrored in the enlargement of the metal ball. Because this metal ball is located in the center of the pelvis it will be enlarged to the same degree as the rest of the pelvis.

On the *x*-ray films we measure the required diameter, and the diameter of the metal ball. An equation is drawn:

$$\frac{X\text{-ray of required diameter}}{\text{True diameter } (X)} = \frac{X\text{-ray diameter of metal ball}}{\text{True diameter of metal ball (1.27 cm.)}}$$

The *x*-ray of the required diameter is a known.

The *x*-ray of the metal ball is a known.

The true diameter of the metal ball is a known (1.27).

Thus we have an equation with three known factors and one unknown factor (X), and the result can be easily calculated.

A half-inch metal ball is used: this equals 1.27 cm. It would have been easier for purposes of calculation if the metal ball were exactly 1 cm., but such a ball is not obtainable in this country today. The half-inch ball is the ordinary metal ball used in ball bearings.

The procedure in greater detail as used on a patient is as follows: The metal ball is placed in a finger cot and tied with a string into the tip. The string is left long. The combination is lubricated and slipped into the rectum. When it passes the internal sphincter it naturally slips into the ampulla. The string is long enough to hang out of the rectum. *X*-rays are taken. The string is pulled out to extract the finger cot and metal ball. The ball is taken out of the finger cot and can be washed and used repeatedly. Whatever diameter is required is found by setting up the proportion as described.

EXPERIMENTAL DATA

A pelvic bone is taken and important points that mark the diameters are marked with lead arrows. These are made by cutting a piece of sheet lead with a scissors. They are taped into position with scotch tape. The object of this maneuver is to be certain that the diameters measured on the *x*-ray film are the same as those measured on the bone itself. The metal ball is taped into position in the same location it would assume if it were inside the rectal ampulla. Anteroposterior and lateral *x*-rays are taken. A Bucky *x*-ray with the following factors is used: 30 M.A., 50 K.V., ½ second, 30 inch distance. This purposeful overexposure accentuates the lead markers rather than the bone.

The actual diameter between two markers is measured, but is left as an unknown to test the accuracy of the method. The measurements taken on the *x*-ray film are: (1) the required diameter, (2) the diameter of the ball. A simple proportion is then set up:

$$\frac{X\text{-ray of required diameter}}{\text{True diameter } (X)} = \frac{X\text{-ray diameter of metal ball}}{\text{True diameter of metal ball (1.27 cm.)}}$$

$$X = \frac{(X\text{-ray of required diameter})(1.27)}{X\text{-ray diameter of metal ball}}$$

X-ray of required diameter of pelvis is known.

X-ray diameter of metal ball is known.

True diameter of metal ball is known. Thus we have three knowns and one unknown (X). From this the true diameter is calculated. It is checked against the true measurement between the lead arrows on the skeleton. The difference is the error.

In ten trials the error has not exceeded 0 to 6 mm. The position of the metal ball is such that the diameters of the inlet, outlet, mid-pelvis or fetal head can be measured from it as a basis.

SOURCES OF ERROR

The anteroposterior and lateral views should be accurate. A turning of the body away from anteroposterior or lateral positions will give a shorter diameter than the true one on the *x*-ray film.

In the experiments on the pelvic skeleton the lead arrows should lay straight, if they are bent the points will be distorted out of proportion on the *x*-ray film.

The centimeter rule should be accurate and if possible transparent. The rule used originally until replaced was off 1 mm. on a 15 cm. rule.

In the patient the pelvic bone is a curve in three dimensions. On the *x*-ray film it is only in two dimensions. It is not always easy to locate the exact point on the *x*-ray film that corresponds to the point on the pelvic bone in the patient. Of course this is overcome in the experimental work on the pelvic bone by the use of lead markers, but dealing with the patient becomes a more difficult matter.

The symphysis, especially the lower border, does not show in the lateral view as precisely as one would like it to, particularly in stout people.

CONCLUSION AND SUMMARY

A method of pelvic measurement is described which has as its principle the insertion of a metal ball of known diameter (1.27 cm.) into the rectum, taking *x*-ray films and calculating the true diameters by a simple proportion. It is simple and accurate, and can be taken with any machine, regardless of target to film distance. No special measuring devices, calculations or equipment is necessary.

KOROSEAL: A RUBBER SUBSTITUTE

W. L. GREEN, M.D.
Visiting Surgeon, Borgess Hospital and Bronson Methodist Hospital
KALAMAZOO, MICHIGAN

COMMON among the many problems confronting those concerned with the operation of any general hospital is that of rubber tubing. Increasing demands of modern medicine and surgery for new and different types of intravenous therapy make cleansing, sterilization, etc., of rubber tubing and connections of paramount importance if serious reactions are to be avoided.

Rubber tubing commonly used for intravenous sets, so-called hard rubber drains, and in blood and plasma transfusions, deteriorates rather rapidly under almost any type of repeated sterilization, and most men have had the disheartening experience of having an intravenous set spring a leak with the loss of precious fluids at a time when it could be least afforded.

In addition to its propensity for rotting, cracking and leaking under certain types of sterilization, rubber tubing tends to stick to itself and if it has been autoclaved with a glass connection in place, it becomes well nigh impossible to remove the connection, the tubing must be cut and the adhering rubber scraped from the glass.

Recently a number of workers have reported that the activity of penicillin, when administered through rubber tubing, is decreased by as much as 25 per cent.

One further serious drawback to rubber tubing is that it is non-transparent and following blood transfusions the cleansing of a length of rubber becomes a major operation. It is indeed difficult to be sure the lumen is entirely clean. When used as tissue or abdominal cavity drains hard rubber tubes, especially, often set up untoward reactions.

With these problems in mind the author began a series of experiments in 1941 using Koroseal as a substitute for rubber tubing.

This plastic material, controlled until recently entirely by the War Department, is superior in almost every way to rubber for common hospital usage. It is flexible, sturdy and withstands the rigors of any type of sterilization. One piece of the material supplied for experimental work has been boiled daily in the usual type office sterilizer for a period of three months with no appreciable change. One other piece is four years old and has been subjected to repeated sterilization and is as unchanged and flexible as in the new state.

The material is also unaffected by acids and alkalies and undergoes little if any change in body fluids when used for cavity or tissue drainage. In regards to cavity drainage Koroseal is radio opaque and shows up well either at the screen or on the film.

One great advantage to Koroseal we found in the first sample supplied was its crystal clearness. Fluids may be observed passing through the tubing as well as if it were clear glass and the cleansing problem is reduced to a minimum for this reason. It also facilitates starting intravenous fluids enabling the operator to note the absence of bubbles, height of column of fluid, etc., in the tubing. The clear character of the tubing is altered by boiling, a white cloudy appearance showing up, but this disappears once complete cooling has taken place.

The only serious drawback we have encountered with Koroseal is that it is only slightly elastic and there is some slight difficulty in making connections. Plastic or glass connections with a one screw turn adaption, however, largely do away with this objection.

At the present time the supply of Koroseal tubing is limited to experimental quantities, but we believe that it will do much to solve the common hospital tubing problem once it is released for full production.

SUMMARY

Koroseal, a plastic substitute for common rubber tubing for hospital use, is presented. Its advantages are: (1) It is almost indestructible to ordinary sterilizing methods. (2) It is transparent, thus facilitating the administration of intravenous fluids and at the same time making the cleansing problem much simpler. (3) It is radiopaque and can be manufactured in whatever size seems most desirable.*

* Koroseal tubing used in this work was supplied through the courtesy of the United States Navy and the B. F. Goodrich Company, Akron, Ohio.

STREPTOCOCCI are Gram-positive organisms, which grow in chains and comprise many different strains. Also members of the same strain often develop varying degrees of virulence.

From "A Short Practice of Surgery" by Hamilton Bailey and R. J. McNeill Love (H. K. Lewis & Co. Ltd.).

INDIRECT INGUINAL HERNIA

REPAIR OF THE ANATOMICALLY WEAK AREA

DAVID BREZIN, M.D.
MIAMI, FLORIDA

IN 1942, McVay and Anson, on the basis of sound, illustrated anatomic studies, published their recommendations for inguinal hernia repair. Briefly, they advocate the suture of the transversus abdominis aponeurosis to Cooper's ligament in the lower reaches of the inguinal canal, from the pubic tubercle to the sheath of the femoral vein. The intervening defect between the femoral vein and the internal inguinal ring they close by suturing transversalis fascia to the anterior surface of the femoral sheath. This type of repair utilizes fascial tissues entirely and is laudable on that count alone. In addition it strengthens the posterior wall of the canal and closes the femoral ring, insuring against both direct and femoral hernia.

We further strengthen the floor of the canal in the defect between the femoral vein and internal ring by suturing the transversus abdominis aponeurosis to the deepest portion of the reflected part of Poupart's ligament. Otherwise we are in complete agreement with the McVay procedure. However, for indirect inguinal hernia there is logically and anatomically one step more.

Consider the nature of indirect inguinal hernia in relation to the recognized and advocated types of repairs. In common, they all reinforce the floor of the canal with muscle or fascia at one level or another in order to prevent recurrent hernia. However, the indirect inguinal sac, whether congenital or acquired, protrudes through the arch of the abdominal ring. Not in the floor of the canal, but in the arch of the abdominal ring is the structural anatomic defect through which the herniation occurs. At that point the descending testes pushed the abdominal layers ahead of it and left the attenuated tissues as the coverings of the cord. Of these, the internal spermatic, which is the prolongation of the transversus abdominis aponeurosis, is continuous with it. The transversus abdominis aponeurosis forms the fascial arch of the internal ring.

Technic. The logical step in the repair of indirect hernia follows: The cord is opened by incising the cremasteric muscle and spermatic fascias. The isolated sac is ligated at the neck and the excess excised. The ligated neck is then allowed to retract through the abdominal ring deep to the transversus abdominis arch. It comes to rest at the level of the transversalis fascia-peritoneal layer of the abdominal wall. The internal and external oblique muscles are retracted upward fully exposing the internal inguinal ring. The aponeurosis on either side of the arch is grasped in Allis forceps and drawn together anterior to the ligated sac neck; imbricating mattress sutures are used to hold it in place. Thus, a double aponeurotic layer is interposed anterior to the ligated sac neck. A double aponeurotic layer is also left in place of an anatomic defect. This, then, is our insurance against recurrent herniation at this point. The remainder of the repair proceeds in the fashion advocated in the initial paragraphs.

SUMMARY

The logical procedure for repair of indirect inguinal hernia is to interpose a fascial layer anterior to the ligated sac neck.

This is done by approximating the transversus abdominis aponeurosis at the arch of the internal ring, thus closing over the anatomically defective area.

REFERENCE

McVAY, C. D. and ANSON, B. J. A fundamental error in current methods of inguinal herniorrhaphy. *Surg., Gynec. & Obst.*, 74: 746, 1942.

INTRA-ABDOMINAL PLACEMENT OF DRUGS

A SIMPLE METHOD

JAMES T. COLLEY, M.D. AND ROBERT H. CLIFFORD, III, M.D.
ROANOKE, VIRGINIA

THIS paper does not intend to discuss the merits or demerits of the intra-abdominal use of the various powders and crystals but rather the difficulties encountered in using the same and to suggest a simple method for overcoming some of them.

Everyone who has used the various powders and crystals, whether in salt shakers, paper packets, or the commercial crystals in the paper shaker, has had the unpleasant experience of having most of the drug adhere to the retractors, wet gloves, stray loops of bowel, and the wall of the incision with the masking of the structures.

The equipment consists of a glass tube three-fourth inch in diameter, twelve inches long, and well annealed at both ends, and a plunger of wood roughly one-fourth inch in diameter and eighteen inches long.

The tube is packed with varying amounts (2, 4, 6, 8 Gm., depending upon the choice of the surgeon) of the drug selected. The ends of the glass tube are plugged with cotton. The tube and plunger are then wrapped together and autoclaved. They are then ready for use.

The method used is as follows: In the case of a perforated appendix with peritonitis. The operation is completed, and the first one or two peritoneal stitches

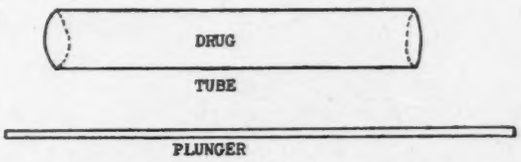

FIG. 1. Illustration of tube and plunger.

taken. The tube is then taken by the operator, the cotton plugs removed, and it is inserted down so that the end rests in the bed of the appendix. The plunger is then inserted into the tube, and with repeated gentle strokes small portions of the drug are inserted into the desired area until the tube is empty. The tube is then withdrawn and closure completed. Some of the drug remaining in the tube is sprinkled into the layers of the wound.

In this manner, it is possible to place a known quantity of the drug at any desired spot without having it removed from the abdomen by the surgeon's hands and instruments.

It is important that the plunger be considerably smaller than the caliber of the tube, for when using a close-fitting plunger, it was found that the drug was expressed in a solid plug which tended to form a cake.

This method has been used in the Jefferson Hospital, Roanoke, Virginia, for four years and has proved to be the most satisfactory of all methods tried for the local application of the drugs.

Case Reports

ABDOMINAL TYPE OF ECTOPIC PREGNANCY

CHARLES BATE, M.D.
Surgeon to Moton Memorial Hospital
TULSA, OKLAHOMA

SINCE the normal place for a pregnancy is within the uterine cavity, an ectopic pregnancy may be defined as that condition in which the embedding growth of the impregnated ovum takes place elsewhere than in the uterine cavity. The term, extra-uterine pregnancy, may be used as a synonym for ectopic pregnancy, meaning that the fertilized ovum may become implanted in the tube, in the ovary or anywhere in the abdominal peritoneum. While an interstitial pregnancy is the usual type of ectopic pregnancy, most cases of ectopic gestation occur farther out in the tube proper. Of the tubal variety most take place in the tubes' outer half or middle. While embryos have been found in the lower uterine segment, in the canal of the cervix and even within the vagina, such cases would be regarded more correctly as forms of abortion rather than true ectopic pregnancy. Occasionally, a pregnancy occurring in the infundibulum projects itself into the abdominal cavity. Whether or not a pure form of abdominal pregnancy ever exists is still open to question in the minds of many. Cases of abdominal pregnancies occur in which the sac ruptures and the fetus is then discharged into the body cavity. In such cases development is possible so long as the placenta remains intact and communication with the mother is maintained. Usually, however, when the fetus is discharged into the abdominal cavity it becomes encapsulated and degenerates. Mummification, maceration or calcareous infiltration (Lithopedion formation) may occur.

In the vast majority of instances extra-uterine pregnancy results from the nidation of a fertilized ovum in some portion of the mucosal lining of the Fallopian tube.

It is generally accepted in women with a twenty-eight day menstrual cycle that ovulation usually takes place between eleven and fifteen days following the onset of the preceding menstruation. It has been established by direct observation that the ovum is slowly extruded on to the surface of the ovary from the ruptured follicle. The ovum is engulfed almost immediately by the fimbriated end into the tube which has been known to assume usual activity at the time, sweeping back and forth over both surfaces of the ovary.

It has been held by good men that nidation can take place only in Müllerian tissue. If this is true, there is no such condition as a primary peritoneal pregnancy. Studdiford[1] maintains that there is a primary peritoneal pregnancy.

My first case leads me to believe that such a condition is possible, for the reasons that both tubes and ovaries were normal, there was no evidence of recent or remote injury to the tubes, there was an absence of any evidence of uteroperitoneal fistula and the pregnancy seemed related to the peritoneal surface. However, primary abdominal pregnancies are not common.

The course of these cases may vary greatly and many symptoms may be presented by the patient causing confusion. The usual history is that the patient has missed one or two periods and then suddenly she develops severe, cramp-like

pains in the lower abdomen. She may pass a small amount of blood, have a chill, become dizzy, nauseated and ultimately collapse. The patient may have a history of previous severe menstrual cramps or of pelvic inflammation. The picture becomes cloudy especially when the symptoms are of peritoneal manifestations.

The diagnosis is not so easy before tubal abortion or tubal rupture has occurred, because the mass is soft as an intestinal loop. It has been said that the way to tell a case of tubal abortion from tubal rupture is that when you see your patient, if she is alive it was tubal abortion, and if she is dead it was tubal rupture and a fatal hemorrhage has occurred. This was known as Harris' rule. However, I have rescued a few tubal ruptures that were leaking slowly. It is important that the doctor carefully sift the history, evaluate all factors, and always listen to an intelligent patient, because she frequently can be of much aid in diagnosis. A careful, gentle, pelvic examination to determine the size and consistency of uterus is of great importance.

The question of the time to operate is, in my opinion, as soon as the patient's condition will allow. The earlier the surgical interference, the better it is for the patient. There also arises the question of what to do with the placenta in abdominal pregnancies at operation.

There are three usual methods of handling these: (1) Complete separation and removal; (2) marsupialization or partial closure and drainage; and (3) leaving the placenta *in situ* with or without drainage. The placenta will usually become absorbed in a short time.

The following are two cases that occurred in my practice within the period of a year:

CASE REPORTS

CASE I. Mrs. E. R., age thirty-seven, para 6, came to my office complaining of cramping pains in her right side and of chills and fever of three days' duration. Her pulse was 110, temperature 102°F., respiration 24, blood pressure 110/70, and hemaglobin 14 Gm. When questioned concerning her menstrual history, she stated that four months previously she had missed one menstrual period, but since then had menstruated one or two days during her regular menstrual time. She had been to a physician and had been told that she had "female trouble." This later proved to be true. Upon physical examination the abdomen was tense and rigid. A pelvic examination revealed a large soft mass, the size of a grapefruit, situated to the right of a small firm uterus. She was hospitalized and given 2,000 cc. of 10 per cent glucose intravenously daily, for two days and also 1 Gm. of sulfadiazine every four hours.

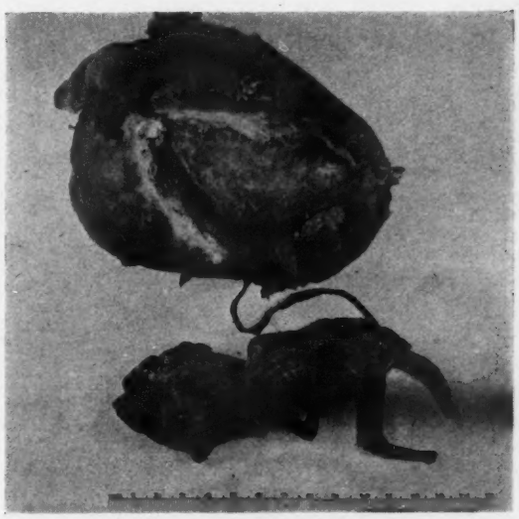

FIG. 1. General view of mass with fetus; gestation sac partly opened.

Her temperature was normal on the third day and under spinal anesthesia her abdomen was opened. A four months' fetus was found in the peritoneal cavity with a moderate amount of hemorrhage. The placenta was attached to the omentum and intestines. The tubes and ovaries revealed no gross evidence of recent or remote injuries or of inflammation. The fetus and placenta were completely removed and 10 Gm. of sulfanilamide crystals were placed in the abdominal cavity and the abdomen closed without drainage. The patient was discharged from the hospital on the twelfth day as well. I believed that this was probably a case of primary peritoneal pregnancy.

CASE II. Mrs. E. F., age twenty-six, para 0, gravida 1, was admitted to my surgical service on October 5, 1945, with a complaint of a painful mass in her lower abdomen.

Fig. 2.

Fig. 3.

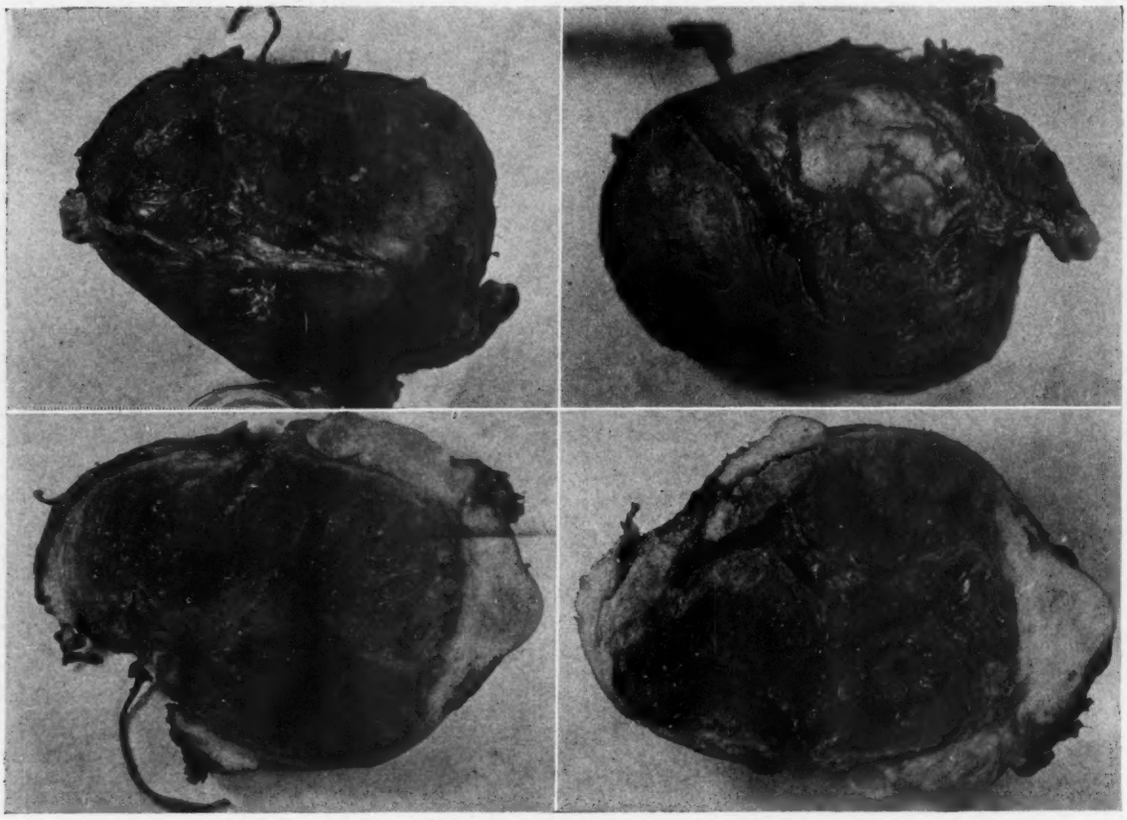

Fig. 4.

Fig. 5.

Fig. 2. Mass from one side, showing tube and umbilical cord.
Fig. 3. Mass from other side, showing again tube and umbilical cord and also ovary (white patch).
Fig. 4. Cross-section showing ovary and tube at periphery, well separated from placental mass which shows amniotic cavity with inserting umbilical cord.
Fig. 5. Cross-section through other level, showing again very thickened, fibrotic and adherent tube, as well as ovary with small follicle cyst both separated from placenta; tube blends into placental mass.

Her last menstrual period was May 10, 1945. General examination revealed an anemic, female, colored patient whose blood pressure was 90/60, pulse 120, temperature 102°F. Physical examination showed normal chest findings. In the abdomen there was a smooth mass extending up to the level of the umbilicus most marked on the right side. The abdomen showed generalized tenderness and the mass was hard and irregular. The pelvic examination revealed the cervix to be posterior, closed and firm. Her hemaglobin was 9.5 Gm., red cell count 3,200,000, and total white count 12,000. The urine was negative except for 1 plus albumen. Because of the history, it was believed that the patient was suffering from intraperitoneal hemorrhage due to an ectopic pregnancy.

She was given a transfusion of 500 cc. whole blood, and under spinal anesthesia a laparotomy was done. On opening the abdomen through a lower abdominal mid-line incision, the peritoneal cavity was found to be filled with fluid and clotted blood. The right tube was inflamed and fastened down to the back of the uterus. The uterus was in normal position and not enlarged. On the posterior aspect of the broad ligament a placenta was firmly attached, and free in the abdominal cavity was a three month's fetus. The placenta and fetus were removed with very little hemorrhage; 10 Gm. of sulfanilamide crystals were placed in the abdominal cavity and the abdomen was closed without drainage. The patient made an uneventful recovery and was discharged fifteen days after operation with the wound well healed and no complaints.

The pathological report October 16, 1945, in Case 11 is as follows: Pathological No. B 1399; Macroscopically, the abdominal mass measured 15 by 13½ by 9½ cm. The mass was covered almost throughout with serosa and at one point it was considerably thickened. The tube could be identified at its outside with the isthmical portion severed from the uterus and the ampullary portion with its fimbrial

end blending into the mass. Close to the tube, the ovary could be identified as a disc-like mass measuring 5 by 3 cm., and contained several small cysts. This ovary also blended with the mass. Part of the ovary, however, and the isthmical portion of the tube could be separated from the mass which appeared to be composed of friable solid hemorrhagic tissue resembling placental tissue. Over an area measuring 6½ cm. in diameter, the mass was not covered with serosa and in this area a very thin umbilical cord was found to be inserted at the umbilicus and measured 9 cm. in length and 2 mm. in width.

Microscopically, the large mass consisted of isolated necrotic chorionic villi embedded in masses of blood clots and fibrin. This necrotic placental tissue was found to be inserted in the wall of the fimbriated end of the tube and separated from the ovary and from the ampullary portion of the tube by granulation tissues rich in blood pigment and lipoid filled histiocytes. The Fallopian tubes showed a severe purulent chronic inflammation involving all layers of the wall. Where the gestation sac was not adherent to the ovary and tube, it consisted of fibrotic granulation tissue. An amnion could be identified lining the inside of one vein and two arteries. The ovary contained follicular cysts.

Diagnosis: Abdominal pregnancy of four months' duration around the fimbriated end of the tube; chronic purulent salpingitis.

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HERNIA PERICARDII*

COMDR. A. LINCOLN BROWN AND LIEUT. SYDNEY F. THOMAS
MEDICAL CORPS, UNITED STATES NAVAL RESERVE

THE pericardium is a sac composed of two layers, the outer fibrous and the inner serous. An abnormal bulge or protusion of both fibrous and serous layers may well be termed a pericardial diverticulum. The protusion of the serous membrane through a defect in the fibrous layer should be designated hernia of the pericardium (*hernia pericardii*).†

A tabulation of all reported instances of diverticula of the pericardium was made in 1937 by Cushing[1] which, with the addition of a personal case, totaled forty. It is of interest to note that, correctly or incorrectly, the first two reported cases were entitled "Hernia."[2,3] The communication between the pericardial cavity and the diverticulum or hernia, may be broad, minute, or slit-like and it may become obliterated leaving a cystic mass lined with pericardial serosa as in instances reported by Yater[4] and Dufour.[5] The majority of observations noted in the literature were postmortem findings; six diagnoses were based solely on *x*-ray examinations and some masses were calcified. Many of the reports are inconclusive as to the pathological condition of the retaining walls, so that exact classification is not possible.

In the case reported by Cushing,[1] the diagnosis was made when aspiration of a swelling to the right of the sternum with replacement by air showed direct continuity of the parasternal mass and the pericardium.

The present case is reported because of the unusual rarity of the condition. The fact that, in retrospect at least, all previously advocated diagnostic aids are exemplified, an additional diagnostic method, roentgen kymography, is presented; and the surgical removal of the hernia in this instance apparently constitutes the first time this procedure has been reported.

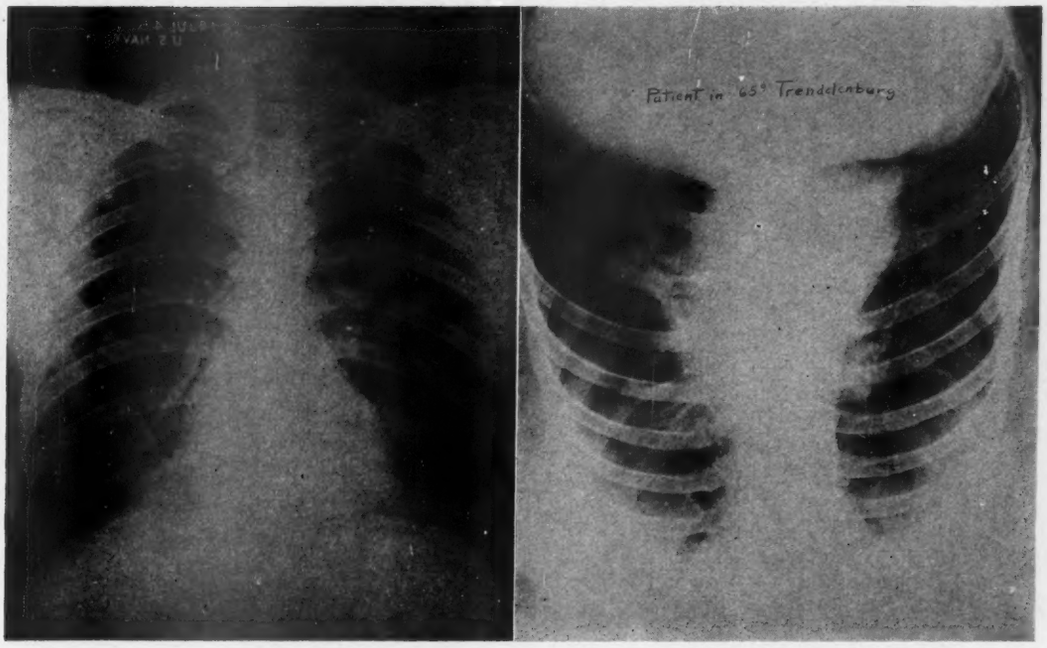
Etiology. These lesions may arise upon either a congenital or an acquired basis. A weakness or defect of some area of the pericardial layers must exist in either case. Normally, there are potentially weak areas along the lines of reflection where the parietal pericardium separates from the two serous layers and merges into the adventitia of the great vessels. To a lesser degree such a potential weakness also exists at every point of entrance of the pericardiac vessels and nerves as well. The acquired cases are considered to result from the further addition of disease (pericarditis, lues, etc.) upon these potentially weak areas or through the direct weakening of any portion of the pericardial wall by local disease or trauma. Obviously any unusual increase in intrapericardial pressure would tend to bulge out a weak spot regardless of its origin.

The acquired cases have also been classified as either pulsion diverticula or traction diverticula by Juderholm.[6] Pulsion diverticula are assumed to develop on the basis of increased intrapericardial pressure and traction diverticula from an external force or pull as might exist from mediastinal adhesions or the weight of an unusual accumulation of pericardial fat.

Diagnosis. The majority of reported instances have been discovered postmortem. By far the greater number of cases

† It is the opinion of the authors that the term "hernia pericardii" is a more correct term than "diverticulum of the pericardium."

* From the Departments of Thoracic Surgery and Radiology, U. S. Naval Hospital, Oakland, Calif. The opinions or assertions contained in the accompanying article are the private ones of the writers and are not to be construed as official or reflecting the views of the Navy Department or Naval Service at large.



A B

FIG. 1. A, shows the rounded shadow of uniform density to the right of the heart and lying on the diaphragm. B, patient in 65 degree Trendelenburg position. With a pneumothorax, mass is no longer visible, having been displaced by change in position and much of its fluid content having flowed into the true pericardial sac.

have had no symptoms directly attributable to the lesion though may have had intrathoracic (usually cardiac) findings. These symptoms could well be explained by other more common disorders in each individual case.

Recently roentgen ray has made possible at least a tentative diagnosis of the condition during life. Kienböck and Weiss,[7] in 1929, pointed out that a soft tissue shadow, arising from and continous with the heart shadow, whose lateral border was sharply defined and which showed a moderate pulsation was consistent with and should lead to the consideration of the possible existence of a pericardial diverticulum.

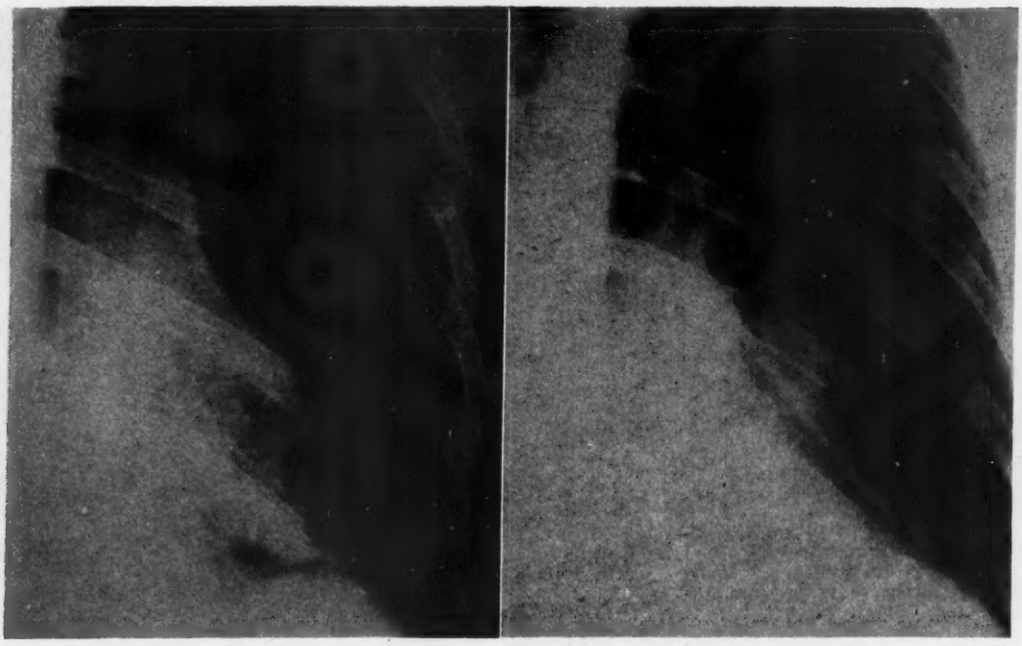
Jansson,[8] in 1931, added an additional highly important *x*-ray observation. He noted a change in size and shape of the soft tissue shadow with respiration; upon respiration the shadow became longer and narrower while it expanded on expiration. This plasticity is not observed in either a solid tumor or in the vascular system.

An additional diagnostic aid may well be kymographic studies. Thus in the case presented herewith the kymogram shows definite increased pulsations in the area of the wall of the soft tissue shadow. One might postulate that the greater the evidence of pulsation in the suspected mass the larger the communication between the true pericardial sac and the hernia or cavity of the diverticulum.

CASE REPORT

This white male, twenty-four years of age, was admitted to the Oakland Naval Hospital for clinical investigation because a routine photofluorographic chest examination had revealed a "tumor mass of unusual character in the right cardiophrenic angle." He had no complaints. The past history was entirely negative save for a severe attack of bilateral pneumonia at the age of seven for which he was kept in bed for months.

Examination revealed a well developed and well nourished white male in no acute distress. The heart was not enlarged to percussion; the rate and rhythm were normal; no murmurs were heard. Blood pressure was 135/70. Examination of the abdomen elicited no masses, tenderness or spasm. The liver and spleen were not felt and there was no costophrenic angle tenderness. Routine blood and urine examinations



A B

FIG. 2. Comparative oblique films, after a pneumothorax had been instituted, taken on inspiration (A), and expiration (B), of right cardiodiaphragmatic region showing change in size and shape of hernial mass under these conditions (observations of Jansson[8]). The mottled density in these films results from retained lipiodol.

were all within normal limits. The Kahn test was negative, and the sedimentation rate was 2 mm. per hour. (Figs. 1A and B.)

An attempt to determine the nature of the original shadow observed by *x*-ray was made by the following studies which are presented in chronological order:

1. Fluoroscopy (chest): Thickened pleura at the right costophrenic angle; chest otherwise normal.

2. Bronchogram: Bronchi to both lower lobes are not remarkable. The density noted in the region of the pleural pericardial reflection on the right is seen.

3. Gastrointestinal Series: Esophagus, stomach and duodenum normal. Progress studies made at three and twenty-four hours disclosed the barium to lie in the lower small bowel and colon which appeared entirely normal.

4. Chest *x*-rays: Fluoroscopy and Kymography: Review of all the films, including the examination of July 18, 1945, shows a rounded uniformly dense mass in the anterior inferior portion of the right thorax mesially. The present examination shows a phneumothorax with about 70 per cent collapse of the right lung, and the mass is clearly delineated and free in the pleural space.

The special films made in the oblique position and in expiration confirm the fluoroscopic finding that the mass is free in the pleural space. (Figs. 2A and B.)

A film made with the head down reveals the right leaf of the diaphragm to have normal contour. (Fig. 1B)

Fluoroscopically and on the kymographic studies of the cardiac silhouette the mass pulsates with the heart but there is no evidence that the lesion is expansile. (Fig. 3.)

Conclusion: "Soft tissue tumor, pulsates with the cardiac pulsations, and measures approximately $10 \times 4 \times 3$ cm.

"The best possibility is a dermoid cyst or some sort of a congenital anlage. The intimate connection with the pericardium is suggestive that it arose there, but the more likely is that it arises in the mediastinum, as the curvalinear appearance of the tumor toward the hilar region suggests a more mesial origin than is demonstrable on these films."

5. Electrocardiogram: Within normal limits.

6. Thoracoscopy: Lying on top of central portion of the diaphragm (right) was seen a bluish, apparently tubular structure over the lateral wall of which there appeared to run a fibrous band (like a tinea). Vessels similar to those seen on the intestine came up from both sides. Beneath the loop was another mass of

Fig. 3. Kymographic tracing showing increased pulsations in the mass to be greater than in the remaining portions of the pericardial wall. (Diagnostic aid observed in case reported herewith.)

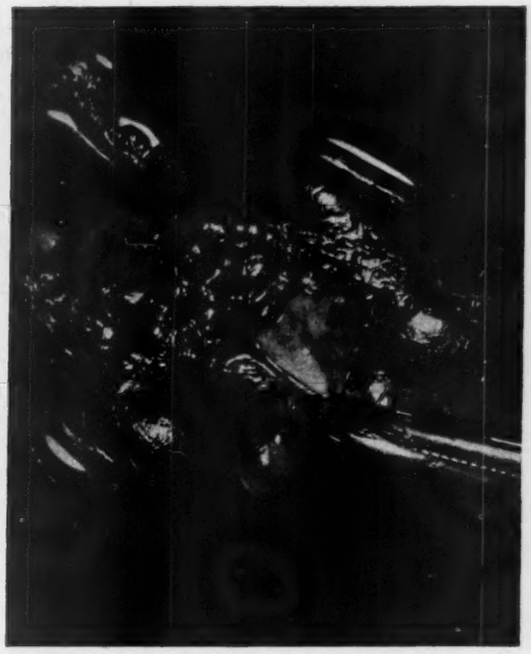


Fig. 4. Specimen removed at operation. Clamp is on tubular structure by which the entire multilocular lumen of the mass communicated directly with the pericardial cavity. Photograph taken after the specimen had been filled with saline through its tubular projection.

the same color covered by vessels and in one area pulsating slightly. Large bowel hernia is a possibility,—otherwise diagnosis of mediastinal anlage must be maintained.

On October 5, 1945, an exploratory thoracotomy was performed with the diagnosis (preoperative): mediastinal rest. The procedure and findings were an intercostal incision, seventh interspace posterior; segments of the eighth and ninth ribs 1 cm. in length were removed subperiosteally. The pleura was opened, and the lung was found well collapsed by a previous pneumothorax. A cystic lobulated mass was found on the right lateral wall of the lower half of the pericardium, measuring about 7.5 by 10.0 cm. This was freed by sharp dissection and ultimately found to be connected directly to the pericardium by a patent tract, the lumen of which was approximately ½ cm. in diameter. The pericardial fluid was seen to swish back and forth between the cystic dilatation and the normal pericardial sac on each systole. The neck of the sac was doubly ligated with a ligature which had been sutured to the fibrous pericardium at its base. The sac was removed *in toto*. (Fig. 4.) The wound was closed in layers after 100,000 units of penicillin in 300 cc. of saline were instilled into the pleural cavity. The pneumothorax was completely removed by placing a catheter under water. The postoperative course was uneventful.

Pathological examination revealed the following: *Gross specimen:* The specimen consists of two irregularly shaped pieces of tissue submitted in Zenker's solution. The largest measures 5 by 3 by 2 cm., the smaller 4 by 3 by 1 cm. The smaller has the appearance of lobulated adipose tissue. On section, the larger is biloculate containing a yellow pasty material. Its wall averages 0.1 cm. in thickness. It is lined by wrinkled yellowish-grey membrane. Its capsule is intact. *Microscopically,* The wall is composed of an outer zone of dense collagenous connective tissue in which there are prominent perivascular collections of lymphocytes. A lining membrane is made of flat, polyhedral cells with large pale nuclei. The nuclei possess one or two prominent nucleoli. The cytoplasm is abundant and faintly acidophilic. There is no evidence of malignancy. Sections of the adipose tissue show no significant change.

The diagnosis is: Hernia, pericardial, serosal, bilocular and normal tissue, fatty.

The authors wish to draw attention to an article by Morton L. Mazer on "True Peri-

cardial Diverticulum" which appeared in the January, 1946 issue of the American Journal of Roentgenology. This case is very similar to the one which the authors report herein.

SUMMARY

1. A brief resume of the cases of hernia, diverticuli and cysts of the pericardium previously reported in the literature is given.

2. The possible etiology of these lesions is discussed.

3. The diagnostic measures which might lead to the correct diagnosis during life are enumerated.

4. The additional diagnostic value of roentgen kymography is presented.

5. The first case of pericardial hernia to be removed surgically is reported.

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SPONTANEOUS CLOSURE OF RECTO-URETHRAL FISTULA FOLLOWING PERINEAL PROSTATECTOMY

KENT A. ALCORN, M.D.
Head of Section on Urology, Mercy and General Hospitals
BAY CITY, MICHIGAN

INJURY to the rectum following urological procedure is uncommon, though such trauma may occur following cystoscopy, use of sounds, transurethral prostatectomy and perineal prostatectomy. The operative procedure most likely to result in a perforation of the rectum probably is perineal prostatectomy. This complication has been quoted as one of the possibilities ever since this technic was devised. This is no indictment of an excellent surgical procedure. Excluding inexperience in perineal dissection, it should be rare even in patients with so-called "thick" perineums and close-set ischial spines, or "narrow" perineums.

While many writers mention recto-urethral fistula as a possible complication, there has been little in the literature to guide one by this embarrassing complication. The usual practice is to divert the urine by suprapubic cystostomy, followed by a closure of the fistula. Added to this, colostomy to divert the feces has been done in order to secure a clean field for closure of the fistula. Young and Stone reported in 1913 a radical technic for repair of a recto-urethral fistula. C. R. Davis, and more recently, Rusche and Bacon, have reported successful experiences with this technic. Corbus and Corbus recently reported spontaneous closure of a recto-urethral fistula after a suprapubic cystostomy had been done.

The writer believes the more modern technics of perineal prostatectomy have reduced the seriousness of injury to the rectum. In the original technic and earlier modifications of it, no attempt was made to do a plastic repair of the vesical neck; nor was the incision in the prostatic capsule sutured. In the older operative procedures, if the Davis hemostatic bag is used, the incision in the capsule cannot be closed. Urine, therefore, seeps around the bag to saturate the wound. If perforation of the rectum has occurred, fecal drainage further complicated matters and spontaneous epithelization cannot be expected.

In the technic of perineal prostatectomy, as modified by Young and reported in 1928, and by Gibson, Hinman, Belt, Johnson and others, the bladder neck is sutured to the prostatic capsule and the curved incision in the capsule then closed snugly. The wound is closed around a small Penrose drain and a urethral catheter is used for urinary drainage. Usually there is very little leakage of urine through the wound with this technic. In the majority of cases, the wound will be dry and healing by the fifth or sixth day. Should the rectum be perforated, evidences of fecal drainage will be present six to ten days postoperatively. By then, primary union of the incision in the prostatic capsule, in most instances, will have occurred. Profuse urinary drainage through the wound will be avoided. Conservative management can then be employed. Immediate suprapubic cystostomy is not necessary. A careful rectal examination should be done to locate the rectal opening. Gentle irrigations of the wound should be done twice daily. A sulfonamide solution may be used, though this point is probably unimportant. Sulfaguanidine orally may be of some aid in sterilizing the lower bowel. Every attempt should be made to keep the feces soft. Rectal tubes should be avoided. A rectal examination one week later should reveal a "puckering" of the fistula. Con-

tinued treatment will result in a decrease in the fecal drainage until only a small amount of local wound infection remains after the fistula has closed. Further care can be managed outside the hospital.

CASE REPORTS

Case I. F. K., aged fifty-four, was admitted to the hospital because of a partial urinary obstruction. The prostate was large (grade IV) and felt benign per rectum. A perineal prostatectomy was performed July 28, 1942. Following euncleation, the bladder neck was approximated closely to the prostatic capsule with three mattress sutures. The incision in the capsule was then carefully sutured after a No. 24 French Emmett balloon catheter had been inserted through the urethra. The levator ani muscles were approximated with two sutures of plain catgut and the wound closed around a plain Penrose drain to the prostatic capsule.

The patient was permitted to get out of bed on the third postoperative day. There was only a moderate amount of urine drainage through the wound, necessitating re-dressing twice daily. On the seventh postoperative day, the Penrose drain was removed. The wound appeared to be healing well. On the eleventh postoperative day, a small amount of purulent drainage was noted on the dressing. The next day, an enema revealed fecal material seeping through the incision. Rectal examination disclosed an opening in the rectum about 1.5 cm. in diameter on the right side. A No. 10 French soft rubber catheter was inserted into the right angle of the wound and gently irrigated twice daily with a sulfathiazol solution. Sulfaguanidine was given orally. Bowel movements resulted in appearance of feces in the wound. However, very little urine drainage seemed to be present.

Under this program, the wound slowly healed. The irrigations became less dirty and purulent. No urine drainage was apparent on the fifteenth postoperative day. The urethral catheter was removed on the nineteenth postoperative day and the patient subsequently voided freely and with good control. The wound became shallow and fecal drainage was noticeably scarce. The patient was dismissed thirty-three days following surgery and twenty-two days after discovery of the fistula. A small opening still remained. This was irrigated and dressed daily until complete wound closure was effected on the forty-third postoperative day.

This patient was examined two months following surgery. The perineal wound was firm; the rectum likewise felt normal.

Case II. F. G., aged sixty-nine, was hospitalized because of complete urinary obstruction. The prostate per rectum was large (grade IV), smooth, and felt benign.

A perineal prostatectomy was performed on December 15, 1943. The rectal wall appeared to be unusually thin. A small opening was made in the rectum while freeing the recto-urethralis fibers. The opening was immediately sutured with No. 000 plain catgut inverting the rectal mucosa. The suture did not penetrate the full thickness of the rectum. The adenomatous prostate was then enucleated through a curved incision in the capsule. The bladder neck was grasped with long Allis forceps for retraction. It was then sutured to the capsule laterally and posteriorly with three mattress sutures. The incision in the capsule was sutured after a No. 24 French Emmett catheter had been inserted through the urethra into the bladder. The levators were not approximated. The divided central tendon was sutured and the wound closed after packing the wound with sulfathiazole crystals. A single plain Penrose drain was used.

The patient was permitted to get out of bed the next day. The wound appeared to be healing normally on the fourth postoperative day. Very little urine seepage was apparent as only one daily perineal dressing was necessary. However, on the eighth day, fecal drainage was apparent. Rectal examination revealed an opening in the anterior rectal wall about 1 cm. in diameter and about 2.5 cm. from the anal margin. The right edge of the incision was not healed. A No. 10 French soft rubber catheter was inserted twice daily through this unhealed portion of the incision and the wound gently irrigated twice daily with a sulfathiazole solution. Sulfaguanidine was given by mouth. By the fifteenth postoperative day, the irrigations of the fistula returned somewhat cloudy but without fecal drainage. There had been no apparent urine drainage after the rectal fistula was observed. Several days later, rectal examination disclosed a puckering of the fistula with no apparent opening. The urethral catheter

was removed on the eighteenth postoperative day and the patient was able to void freely with good control. No urine leakage occurred from the wound. He was dismissed from the hospital on the twenty-third postoperative day. A small perineal dressing changed daily cared for the slight purulent drainage which persisted. This patient was examined two months later and the perineal wound and the rectum found to be perfectly healed.

In the first patient, fistula resulted from inclusion of the rectal wall in a suture of the levator ani muscles. Ordinary care in this approximation will prevent this complication. In fact, it is not necessary to suture these muscles as has been demonstrated many times.

More careful dissection of the perineum in the second patient would have probably prevented the tear in the rectal wall, though in rare instances, exceptionally friable rectal walls are encountered. Immediate suture should be done but a fistula is almost certain to result.

CONCLUSION

Spontaneous closure in two cases of recto-urethral fistulas is reported. Diversion of the urine or feces was not necessary.

Perforation of the rectum should be a rare occurrence if ordinary care is used in the technic of perineal prostatectomy. Should it occur, it need not be a serious complication if reconstruction of the bladder neck and complete closure of the capsular incision has been done. Simple irrigations done gently through the drainage opening at the angle of the wound should bring spontaneous healing of the rectal fistula. Because the prostatic wound is snugly closed, urine drainage will be absent or negligible. Suprapubic cystostomy should not be performed until this simple clinical management has failed.

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RETROPERITONEAL FIBROMA WITH CALCIFICATION*

MALCOLM J. FORD, M.D.
Senior Assistant Surgeon, United States Public Health Service

AND

ROBERT D. DUNCAN, M.D.
Surgeon, United States Public Health Service

SPRINGFIELD, MISSOURI

PRIMARY retroperitoneal tumors of indeterminate origin are relatively rare. Frank[1] has reviewed the literature from the period 1925 to 1936, finding 107 cases and adding three of his own. In this category pure, unattached fibromas appear to be especially rare. Wolfer,[2] in 1934, presented a case and reported finding only eleven others in the literature. We have been able to find reports of only two cases since 1934, these being by Fulton[3] and by Luciani.[4] Therefore, we believe our case to be of sufficient interest to warrent reporting.

CASE REPORT

The patient, C. W., was admitted to our institution April 7, 1945, with the complaint of a mass in the abdomen of nine years' duration. In 1920, he was kicked by a mule in the left lower posterior chest region. There had been recurrent dull pain in this region, accentuated by stooping or lifting, dating from the time of the injury. In 1936, he first noticed a swelling in the left upper quadrant and this had steadily increased in size. For the six months previous to admission he had had vague abdominal complaints associated with occasional vomiting of small amounts of food. There was shortness of breath and the patient was unable to work. During this latter period he had lost twenty pounds in weight. There was a history of recurrent attacks of malaria in childhood and up to 1910. Physical examination revealed him to be well developed and nourished. He was deeply tanned but otherwise there was no unusual pigmentation of the skin.

There was a large, very firm mass causing a protrusion of the abdominal wall which could be seen at a distance and which seemed to be occupying the entire left side of the abdomen. This mass had a smooth surface and a sharp border which appeared to have many small notches. It was not tender. It appeared to move downward with inspiration and the examining hand could be passed between it and the costal margin. The remainder of the abdominal examination was essentially normal. Urine examination showed four hyaline casts and occasional mucous cylindroids per high power field. The blood showed 14.0 Gm. of hemoglobin per 100 cc. of whole blood, 4,900,000 red blood cells and 7,850 white blood cells per cubic millimeter, with a normal differential count. The color index was .95 and the red cells were normal in size and shape. A blood smear was negative for malaria and the icteric index was reported as 6 units. An intravenous pyelogram showed normal function in both kidneys with displacement upward of the left kidney and medially of the left ureter. The shadow of a large tumor could be seen containing a deposit of calcium measuring 8 by 13 cm. A gastrointestinal series showed the stomach to be pushed upward and to lie in an oblique position. The Jejunum was displaced into the right abdomen, the descending colon to the right, and the transverse colon upward, particularly at the splenic flexure.

On June 7, 1945, a laparotomy was performed using a left rectus incision and revealed a large retroperitoneal tumor located just to the left of the mid-line in the central portion of the abdomen. The descending colon was raised upon the surface of the tumor and displaced toward the mid-line. The mass extended through the entire left side of the abdomen from the pelvic region to the level of the spleen. It had a fibrous capsule which was adherent to the inferior vena cava and for this reason a portion could not be removed. The blood supply seemed to be derived from a number of rather small blood vessels off the external iliac artery and vein. The spleen was enlarged and there seemed to be a number of small, superficial calcifications over its surface. The re-

* From the U. S. Medical Center for Federal Prisoners, Springfield, Mo.

FIG. 1. Flat plate (postero-anterior) of abdomen showing calcified tumor.

FIG. 2. Intravenous pyelogram showing tumor and renal pelvis deformity.

mainder of the abdominal organs were normal. The postoperative course was essentially uneventful.

Pathological examination showed an egg-shaped, shiny, hard mass having a grey color, a smooth surface and weighing 2,710 Gm. On section there was a densely calcified mass, roughly oval in outline and measuring 3 cm. at its greatest diameter. The cut surface showed shiny, whorled and white coarse bands of fibrous tissue. The microscopic section showed the specimen to consist of interlacing bands of fibrous tissue. The amount of collagen varied considerably and in the heaviest collagenized areas it was almost acellular. There were a few small foci of myxomatous degeneration but also many nests of actively proliferating fibroblasts. None of the latter were seen near the capsule. The sections which included the capsule showed it to be a heavily collagenized structure. Sections of the calcified area revealed merely calcium deposits on an acellular stroma.

We believe our case presents several interesting aspects. The relationship to trauma is of interest. The tumor was closely associated with an incident of trauma both in history and in location. It has been stated by Andrews[5] that trauma is apparently not a factor in the cause of retroperitoneal sarcoma. We have found no similar statement as to retroperitoneal fibroma but believe that our case may be considered as fulfilling the postulates of Segond.

Carson[6] lists these criteria as, (1) the authenticity and adequacy of the trauma, (2) the previous integrity of the wounded part, (3) a reasonable time relation, from three weeks to three years or more in some cases, (4) continuity of the symptoms of the injury with those of the tumor, (5) microscopical or other proof of the existence and histological type of the tumor, and (6) location of the tumor at the point of injury. The previous integrity of the wounded part in our case can be inferred from the absence of symptoms prior to the injury. The location of the tumor at the point of injury is not as exact as in most cases cited in the discussion of this topic. These are unusual incidents involving extremities, which permit of more exact location than in the case of the chest or abdomen. The time relation is also considerably longer (sixteen years) than the limits given by Carson, but here again the abdominal location of the tumor com-

bined with its slow growth might explain the discrepancy. We realize the fallacy of drawing conclusions from only one case and that our observations may be based merely on coincidence, but due to the rarity of the lesion the rather definite association with trauma in our case would seem to make such observations worthy of mention.

Another aspect of interest is in relation to the differential diagnosis. Enlargment of the spleen is a frequent differential diagnosis with retroperitoneal tumors. The most frequently mentioned preoperative diagnosis in this case was splenomegaly of some type. The patient had been transferred to our institution with this diagnosis and gave the history of having been hospitalized for operation several years previously with decision against operation after consultation with numerous physicians. This latter might suggest that splenic tumor was considered at that time. In our preoperative examinations the left kidney was found by intravenous pyelogram to be displaced.

According to Wolfer[2] the left kidney is not displaced by splenic enlargement. However, Shulte and Emmett[7] state that displacement of the kidney may be caused by a lesion of any intra-abdominal organ. One of their cases in point showed downward displacement and rotation of the left kidney resulting from an enlarged spleen. They also state that in 72.5 per cent of a general group of 112 cases of retroperitoneal tumor there was displacement of the kidney, ureter or both. Hence it would seem that while this sign of displacement of the kidney should be considered it cannot be depended upon as a final solution in the diagnosis as regards splenomegaly. Lesions of the gastrointestinal tract may be ruled out by *x*-ray with barium contrast medium. Other conditions that can be ruled out only by exploration are sarcomas, mesentric or omental cysts, dermoids and teratomas.

As to the calcification of the tumor, we have found such a condition reported only once previously in the literature, that being in the case reported by Fulton.[3] There is some doubt, however, as to whether this may be as rare a condition as suggested, since some of the earlier cases were not subjected to a thorough pathological examination. Our case showed considerably more calcification than Fulton's. The process of calcification was probably due to degeneration of the tissues in the central portion of the tumor. The blood supply of the tumor was obviously inadequate and degeneration of the interior of the tumor as it continued to grow would seem to be inevitable. There was no evidence of a definite structure which would suggest a teratomatous lesion. The lesion was considered to be benign and the subsequent course has substantiated this.

FIG. 3. Gastrointestinal series showing displacement and deformity of stomach and displacement of colon and small bowel to the right side.

SUMMARY

1. A case of retroperitoneal fibroma is presented.

2. Only thirteen previous cases are reported in the literature.

3. Points in the etiology, pathology and diagnosis of the case are discussed.

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Lesions, abscesses, and tumors of the thoracic and abdominal cavities metastasize through the vertebral veins without involving the portal, pulmonary, or caval system (Batson).

From "Metastases Medical and Surgical" by Malford W. Thewlis (Charlotte Medical Press).

ARTERIOVENOUS ANEURYSM OR FISTULA

A. J. CALIENDO, M.D.
Associate Attending Surgeon, Norwegian Hospital
BROOKLYN, NEW YORK

THE incidence of arteriovenous fistulas following war wounds will probably increase and one should be prepared to recognize them and give the proper treatment. The simplest definition of an arteriovenous aneurysm is that it is a direct, unnatural communication between an artery and a vein usually due to trauma. The mechanism of the formation of such a communication is the simultaneous wounding (puncture) of the approximating artery and vein especially when enclosed in a common sheath without much disturbance of surrounding tissues and no extravasation. This type of aneurysm can readily result from shrapnel, bullet and similar wounds. Arteriovenous fistulas have also resulted from such surgical procedures as herniorrhaphies and tonsillectomies in which the surgeon's needle accidentally punctures two approximating vessels.

Two main types of arteriovenous aneurysms have been described with several varieties: (1) Aneurysmal varix which has no intervening sac. It is merely a plexus of veins forming a pulsating swelling that communicates with the artery. It is, therefore, not apt to rupture so easily; (2) varicose aneurysm in which there is a fibrous walled sac formed between the vessels which can gradually dilate and eventually rupture. There are several varieties of arteriovenous aneurysm, as illustrated in Figure 1.

The vessels most apt to be involved are the popliteal artery and vein, femoral artery and vein, internal carotid and internal jugular, brachial artery and median basilic vein; internal carotid and cavernous sinus, facial artery and vein, posterior tibial vessels and vessels of the orbit.

Symptoms and signs of arteriovenous aneurysm are: (1) Local swelling which occurs in a few hours to a few days; it is soft, reducible and pulsating; (2) systolic thrill on palpation; (3) systolic bruit on auscultation; (4) dull aching pain with various nerve disturbances, when the mass becomes large enough to exert pressure. Distal swelling of an extremity may also occur from a disturbance of the return circulation. (5) When the carotid and jugular vessels are involved or any branches in or near the skull, the bruit or murmur can become so loud and persistent as to interfere with sleep and rest.

DIFFERENTIAL DIAGNOSIS OF ARTERIOVENOUS ANEURYSM

Highly vascular tumors or cysts of any type, as sarcomas and tumors of the carotid body, may resemble arteriovenous aneurysms. Location, presence or absence of a bruit, attempt at aspiration, history of trauma and possible biopsy may help in the differentiation. In taking a biopsy the possibility of an arteriovenous aneurysm must always be borne in mind.

Thyrotoxicosis is very often hard to differentiate when the lesion is in or near the skull (common carotid and cavernous sinus), producing a pulsating exophthalmos with an audible bruit. The basal metabolic rate and any history of injury to the skull may help to differentiate.

Simple Aneurysm must be differentiated for the following reason: Ligation of the artery proximal to an arteriovenous aneurysm will cause circulatory embarrassment and perhaps gangrene. The best test of differentiation is by digital compression:

Compression of the artery proximal to the aneurysmal mass in an arteriovenous aneurysm will produce a systolic thrill and bruit, prominence of the veins in the region of the fistula, slowing of the pulse and

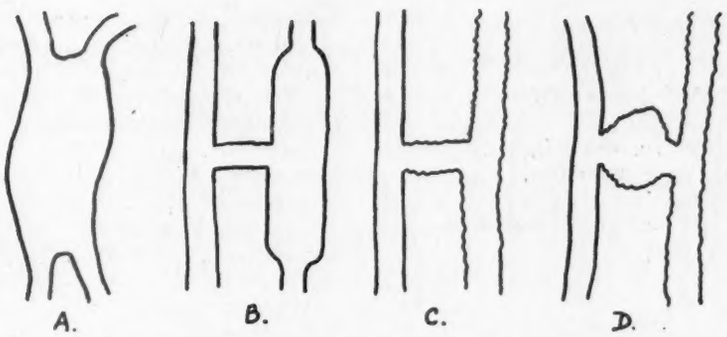

Fig. 1. Diagrammatic illustrations of varieties of arteriovenous aneurysms; A, direct communication; B, aneurysmal varix; C, small fibrous opening communication; D, varicose aneurysm.

increase in the blood pressure. Compression of the artery proximal to a simple aneurysm produces no effect on pulse or blood pressure.

TREATMENT OF ARTERIOVENOUS ANEURYSM

There is no tendency to spontaneous cure of an arteriovenous aneurysm. If left untreated, the larger ones may rupture or result in cardiac hypertrophy due to the increased volume of blood thrown on the heart. Surgery is the only method of treatment.

If the lesion can be approached the artery and vein are ligated proximal and distal to the false opening. After the ligation of these vessels, proximally and distally, the entire mass may be excised *en masse* and the wound sutured.

If the lesion cannot be approached, as in the base of the skull, etc. the afferent artery is ligated (subject to the risk of cerebral ischemia) in the hope that the diminution in the blood current relieves the symptoms. At times this is not advisable and the best that can be done is exposure of the area and tamponade.

CASE REPORT

A patient was admitted to the hospital with a painful, pulsating mass in the left ankle, numbness in the first and second toes of the left foot and slight swelling of the left foot and ankle. The past history was essentially negative except for the injury leading to the present illness.

The present illness began eight months previous to admission. While cutting some high grass with a machete, it slipped and cut him on the inner aspect of the lower left leg near the ankle joint. He was taken to a hospital where the wound was sutured and it healed without trouble. About eight months later he began suffering from throbbing and aching pain in the area of the wound and noted that the first and second toes of the left foot felt numb with slight swelling of the left foot and ankle. The condition became progressively worse and three weeks later he reported to the dispensary of the hospital where he was admitted.

Physical examination revealed a pulsating, tender mass on the medial aspect of the left ankle just above the ankle joint. Compression applied digitally just above the mass produced a systolic thrill and bruit. We knew we were dealing with an arteriovenous aneurysm. Further check-up disclosed a slight rise in blood pressure and decrease in pulse rate as the digital compression was maintained.

Operation was performed several days later. Excision of an arteriovenous aneurysm of the posterior tibial artery and vein was done. The artery and vein proximal and distal to the pulsating mass were ligated, the mass freed and removed *en masse*, all bleeding controlled and the wound sutured. Healing took place by primary union and the patient was discharged from the hospital entirely free of symptoms.

CONCLUSION

A case of arteriovenous aneurysm of the posterior tibial artery and vein has been presented with the surgical treatment instituted. One should bear the condition in mind especially in men returned to civilian life with old war wounds.

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A TENSE anal haematoma, resulting from rupture of one of the anal veins, commonly occurs on the lateral aspects of the anal margin, and it is in this situation that excision of the swelling is most suitably carried out. The operation should be done when the haematoma is single and tense, before the overlying skin has become ulcerated and before the clot has discharged with risk of local infection.

From "Minor Surgery" edited by Humphry Rolleston and Alan Moncrieff (Philosophical Library).

LYMPHOSARCOMA OF THE RECTUM*

FIVE-YEAR CURE FOLLOWING LOCAL REMOVAL

FRANKLIN I. HARRIS, M.D.
Chief of Division of Surgery,
Mount Zion Hospital

AND

GERALD MASON FEIGEN, M.D.
Adjunct Surgeon, Anorectal Surgery,
Mount Zion Hospital

SAN FRANCISCO, CALIFORNIA

THE purpose of this case report is to present a five-year cure of a rectal lymphosarcoma which was treated only by local excision and fulguration rather than by more radical surgery.

The generally accepted treatment of rectal lymphosarcoma has been radical surgical excision of the rectum when possible, followed by radiation, or radiation alone in inoperable cases. Hayes, Burr, and Pruitt,[1] in 1940, stated: " . . . regarding lymphosarcoma, all are agreed that metastases occur early and that the only hope of a cure is early radical removal, followed by irradiation." Rankin and Chumley[2] reported the results of fifteen resections for lymphosarcoma of the rectum and colon with four operative deaths, five with known recurrence at the time of writing, and an average length of life of eleven and a half months. One patient lived one year and another four years without recurrence. Tuta and Rosi[3] reported a case in 1942 in which the patient was treated with local wide excision followed by irradiation. There is no follow-up report as yet. T. E. Smith,[4] in 1943, reported a case simulating an internal hemorrhoid which was removed and then treated with irradiation. In 1943, Rosser[5] stated that there was no agreement at that time as to the proper management of lymphoid tumors of the bowel. N. D. Smith[6] summarized the treatment of such tumors by stating that it can be divided into three types: symptomatic, surgical and that by radiation, and usually two or three types are combined. He adds that surgical treatment of the part has produced some apparent cures, and radium and roentgen rays have produced some very striking results.

The following patient was treated by local snare excision with fulguration:

CASE REPORT

M. H., a thirty-five year old white female, began to have diarrhea in the latter part of November, 1940. It consisted of three to five soft stools daily with some sharp rectal pain occurring momentarily with each defecation. There were also several episodes of tenesmus. This continued for eight days, and during the latter two days of this period she had two to three bowel movements daily with thick yellow mucus and some small dark red clots, and one to two light brown stools. On November 30, 1940, she was examined and a small polyp, about 1 cm. in diameter with 5 mm. base, was seen on the posterior rectal wall, just inside the internal sphincter. This was removed with the diathermy snare and completely fulgurated at the base with diathermy. The tumor was examined by Dr. G. Y. Rusk, pathologist at Mt. Zion Hospital at that time, who reported: "Microscopic examination of polypoid mass from rectum shows the epithelium and mucous membrane normal. In the submucosa and subjacent tissues are a number of variably sized clusters of small mononuclear cells, lymphocytic in type. Some of the cells show less densely chromatic staining than typical lymphocytes. Cells in mitotic division are present in moderate numbers. The growth invades the deeper structures and through strands of connective tissue. Differential staining for reticulum fails to disclose argyrophilic fibrils related to the tumor cells. Diagnosis: Lymphosarcoma." (Fig. 1.)

Examination of the operated area two weeks later revealed a small crater-like depression on

* From the Department of Surgery, Mt. Zion Hospital, San Francisco.

the posterior wall, just inside the anal canal. Hospitalization was again recommended for more complete study.

Physical examination on admission to the hospital was not remarkable. Except for a few small palpable anterior cervical lymph nodes and slightly enlarged bilateral inguinal lymph nodes, there was no lymphadenopathy. Blood count: hemoglobin 12.7 Gm., 82.7 per cent; white blood cells 12,100; polymorphonuclears 66; monocytes 4, lymphocytes 30; filamented 79 per cent; coagulation time 3; bleeding time 3; urine—trace of albumin, seven to eight white blood cells per high power, five to six red blood cells; serology—negative.

Sigmoidoscopy disclosed posteriorly, just inside the internal sphincter, a shallow granulating ulcer at the site of the removed polyp. The base appeared healthy. Barium enema showed multiple diverticula of the descending colon; otherwise it was normal. On December 21, 1940, another biopsy was taken from the fulgurated area. This showed no evidence of the tumor noted in the previous biopsy. She was discharged to the out-patient department on December 23, 1940, for follow-up. On January 7, 1941, it seemed that there was some change in the operated area, and it was decided to readmit her to the hospital for further consideration and possible radical surgery. Her case was discussed at Grand Surgical Rounds, where a variety of opinions were expressed by different surgeons as to how she should be treated. It was decided finally to give no other treatment and observe her carefully in the out-patient department. On January 14, 1941, she was discharged and followed in the out-patient department at intervals of three to four months until June 15, 1943. At that time she felt well, had no rectal complaints, and there was no palpable or visible signs of recurrence. The patient has been seen at intervals since then, the last time in November, 1945, at which time the findings continued to remain negative and she was in good health.

There is some confusion among pathologists as to the exact nature of this disease. The lymphocytic type of lymphosarcoma is a true neoplasm, infiltrative and destructive. Kundrat[7] believed that it originates in a single site and then extends along the lymphatic system, forming diffuse infiltrations more or less distant from the original site. There is no question, however, as to whether every lymphocytoma which appears to be invasive and to show mitotic figures is clinically equally malignant. Whether the term "benign lymphoma," as mentioned by Boyd,[8] is acceptable or not, there appear to be localized lymphocytic tumors which may be encountered in the bowel and which are not clinically malignant, although in microscopic appearance they are identical in many respects with the clinically malignant type of lymphosarcoma. Ewing[9] calls lymphosarcoma of the rectum a malignant lymphocytoma. The question is raised: Is there a benign lymphocytoma of the rectum? Our case would seem to belong in this category. The fact that this growth was small, polypoid, single and unassociated with any symptoms of systemic involvement, led to the decision to treat it conservatively and thus avoid the risk and consequences attending radical surgery. Continued, careful observation for a period of five years has disclosed no evidence of recurrence. We believe we are justified in concluding that an occasional rectal polyp which proves to be histologi-

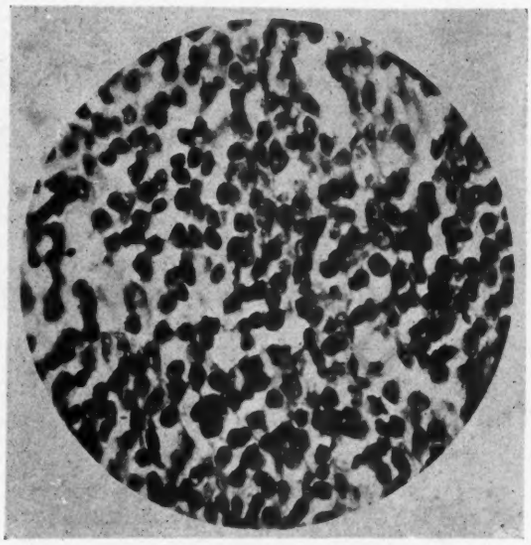

FIG. 1. Microphotograph of section of rectal lymphosarcoma. The tumor is composed of a solid sheet of small lymphocytes enmeshed by a fine fibrous stroma. Two mitotic figures are readily noted. The stroma does not contain argyrophilic fibrils. × 600.

cally lymphocytoma may also prove to be clinically benign and can be treated successfully by local conservative surgery.

SUMMARY

A case of lymphosarcoma in a rectal polyp is presented. Treatment consisted only of local removal with the diathermy snare and fulguration of the base. There is no evidence of recurrence after five years.

It is suggested that lymphosarcoma of the lymphocytic type, when occurring in a polyp and unassociated with any evidence of involvement of the general lymphatic system, may be clinically not malignant, or of such a low grade of malignancy as to permit successful treatment by thorough local removal and continued careful observation.

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TOTAL RESECTION OF THE CLAVICLE

SIDNEY M. COPLAND, M.D.
Senior Surgeon, The Department of Surgery, Touro Infirmary
NEW ORLEANS, LOUISIANA

THE total resection of the clavicle is a rare surgical procedure and the information in the literature concerning it is exceedingly scanty.

Gurd[1] resected the entire clavicle in a young girl in 1912. Cohn[2] resected the clavicle in a young man suffering from a pathological fracture, due to a metastatic malignancy in 1926. Gurd[3] has reported three cases in which he has resected the outer half of the clavicle for severe acromioclavicular displacements and has done several complete resections since the aforementioned report.

During the past two years I have performed a total resection of the clavicle in two cases and since the procedure has yielded such satisfactory results, it is deemed advisable to focus more attention upon its merit.

CASE REPORTS

CASE I. B. K., a fifty-two year old, white, male was admitted to Touro Infirmary on May 6, 1944, with a complaint of pain in the left shoulder of three weeks' duration. *X*-ray examination revealed a pathological fracture at the junction of the middle and distal third of the left clavicle. The left clavicle was resected *in toto* on May 12, 1944, and a Desault dressing applied. The specimen revealed a metastatic adenocarcinoma of the clear cell type. He was up walking about the ward on May 14, 1944, and did not complain of pain. Subsequent work-up of the patient revealed a hypernephroma.

Comment. The clavicle was resected in preference to doing a biopsy. If merely a biopsy had been done, the patient would have continued to have pain. After one week all immobilization dressings were discarded. There was no resulting deformity and all motions were present.

CASE II. E. A., a thirty year old, white male was admitted to Touro Infirmary on February 18, 1945, for a severe comminuted fracture of the left clavicle that had been incurred several hours before. It was my intention to do an open reduction at operation on February 19, 1945. However, at operation, it was found out there were four large comminuted fragments that were razor sharp and required removal. After removal of the fragments it was impossible to bridge the resulting large defect with wire or a plate. I then decided that the only recourse was to resect the clavicle. A Desault dressing was applied. The patient was ambulatory the next day and discharged on February 21, 1945.

Comment. The patient was immobilized for one week and returned to work as a policeman in three weeks. There was no resulting deformity nor any limitation of motion. I had treated this patient three years previously, by conservative methods, for a fracture of the right clavicle. He stated that he preferred his second experience over the first, for he did not have as much discomfort, nor as long a period of disability. Of course, this is mentioned only to illustrate that the total resection of the clavicle is not a shocking procedure.

The clavicle is a slender, flat, doubly curved bone which articulates with the sternum medially and its outer extremity articulates with the acromion of the scapula. It is attached to the caracoid process by the coracoclavicular ligaments. The function of the clavicle has been described as a prop to hold the shoulder outward and backward from the trunk and to support the scapula. This is not true. Weinstein[3] dissected a cadaver with bilateral congenital absence of the clavicles and inquired into the patient's past to know if she had lead a normal life or had been handicapped. She was normal in

every way according to acquaintances. Gurd[4] states, "The clavicle does not act as a strut nor does it support the shoulder. That these statements are true is proven, I believe, by the fact that complete removal of the clavicle is not followed by either shortening of the distance from the tip of the shoulder to the midline of the body, nor by dropping of the shoulder on the affected side." My experience confirms this observation. It is amazing to see these patients use an extremity so freely just two weeks after operation. One then asks the question, "What is the function of the clavicle?" Gurd[5] states, "He is more than ever, convinced that, apart from its function in serving for the attachment of muscles, this bone serves no useful purpose."

It is not intended that all fractures of the clavicle be treated so radically nor that resection of the clavicle has frequent indications. It is a procedure of definite value in the armamentarium of bone surgeons and is indicated in pathological fractures of the clavicle, severe acromioclavicular displacements, severe comminuted fractures of the clavicle with loss of substance, and possibly to afford a better exposure in operating structures deep in the chest.

CONCLUSION

1. Total resection of the clavicle is not a shocking operation and has a relatively short period of disability.
2. It is not followed by deformity or loss of function.
3. The principal function of the clavicle is to act as a muscle support.
4. Resection of the clavicle is indicated in pathological fractures of the clavicle, severe acromioclavicular separations, severe comminuted fractures of the clavicle with loss of substance, and possibly to afford better exposure to thoracic structures.

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ABERRANT PANCREATIC TISSUE IN THE GALLBLADDER WALL

LIEUT. COL. PAUL N. MUTSCHMANN
MEDICAL CORPS, ARMY OF THE UNITED STATES

REVIEW of the available literature shows numerous reports of the presence of aberrant pancreatic tissue in the gastrointestinal tract but relatively few reports of pancreatic tissue in the gallbladder. Faust and Mudgett[1] review the literature describing aberrant pancreatic tissue in general, with the report of one case, and mention two cases in which the gallbladder was involved.

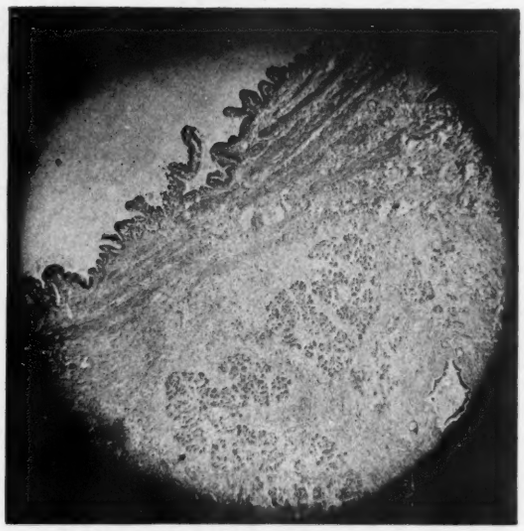

FIG. 1. Microphotograph of section of gallbladder wall, low power.

CASE REPORT

Mrs. R. R., a white female, housewife, aged forty, first reported for examination because of abdominal pain with intermittent cramps radiating to the left shoulder and the left arm. Pain of this nature, of moderate severity, had been present intermittently for ten days. The onset was rather sudden and not related to any particular activity or food. There was some nausea and occasional emesis of bile-stained fluid. No history of similar previous disturbances or of gastrointestinal complaint was elicited, although the patient avoided greasy or fatty foods because of the formation of "gas" and abdominal distention.

Her father and mother had died of diabetes. Seven brothers and one sister were living; one sister had diabetes. The patient had two children living and well. In 1927, the patient was operated upon and both tubes, ovaries and appendix were removed.

Physical examination revealed a well nourished individual weighing 140 pounds. Her skin was clear and pink; the head, nose and throat revealed nothing abnormal; the chest was symmetrical; there was limited excursion of the chest wall on inspiration due to pain in the right and left upper quadrants; the lungs were clear on percussion and auscultation. The heart was normal in position and size; the heart sounds were clear, distinct and regular. Blood pressure was 144/88, temperature 99°F. The abdomen was rounded and had a thick wall of subcutaneous fat; there was definite muscle rigidity of the right rectus muscle above and below the level of the umbilicus. There was diffuse tenderness over the entire abdomen, more marked over the right epigastrium. Above the level of the umbilicus on the right, a definite soft tumor mass moderately tender, could be palpated. There was noticeable tenderness on percussion over the right kidney region. The examination otherwise showed nothing abnormal.

The genitourinary tract examination revealed nothing abnormal. An electrocardiographic tracing was normal.

Laboratory findings revealed red blood cells 4,000,000; white blood cells 7,700; polymorphonuclears 78; lymphocytes 21; basophiles 1; sedimentation rate normal; urine occasional red and white blood cells; Kahn negative; non-protein nitrogen 33 mg; sugar 129; chlorides 470; icteric index 9.2.

The patient was operated upon August 15, 1944. The usual skin preparation and draping was carried out; an upper right rectus incision was made. Moderate bleeding occurred with good hemostasis. On opening the peritoneum, no free fluid was found; the right liver lobe extended about three fingers below

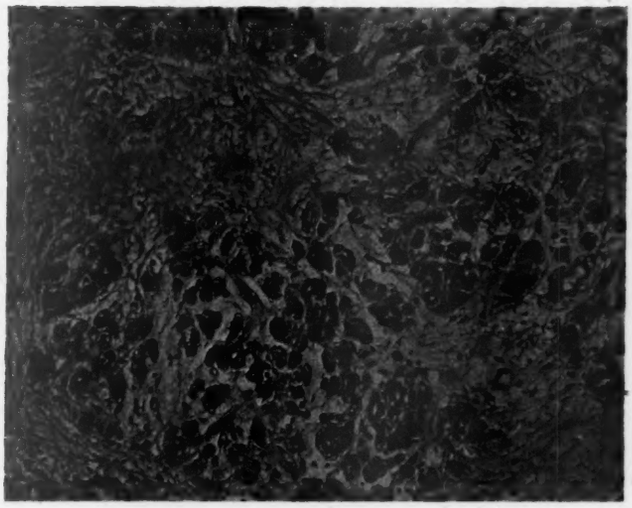

Fig. 2. Microphotograph of section of gallbladder wall, high power.

the costal margin, sharp-edged, with several streaks of white areas throughout the visible lobe of the liver. The gallbladder was greatly enlarged, greenish-gray in color, thick-walled and tense. Several large glands could be felt at the junction of the cystic and common ducts. No stones were palpable in the region of the cystic or common duct. The contents of the gallbladder removed from below upward; the cystic duct and cystic artery were ligated separately. The gallbladder bed was approximated with a running plain catgut suture. Search for the appendix revealed none, but a number of thick, old adhesions were found in the right pelvic area. The pancreas was not thickened or hard. The abdomen was closed in layers with one rubber tissue drain leading down to the cystic duct. Chromic catgut was used throughout. The postoperative condition was good. The gallbladder, opened after removal, was found to be thick-walled, edematous, with a rough, thickened mucosa. Several small sand-like calculi were found.

On August 29, 1944, following the complaint of increasing pain in the right flank and the appearance of fullness in this region, a stab wound was made to the right of the previous operative incision and about 4 ounces of bile-stained fluid was removed. Following this, the patient recovered speedily and was discharged on September 19th.

The pathological examination report was as follows: (Gross) The gallbladder measures 8 by 4 by 2 cm. The neck of the gallbladder apparently had been incised before fixation. The serosal surface is yellowish-gray, mottled with hemorrhage. There are numerous fibrous tags over the entire surface. On section, the wall is markedly thickened, measuring from 3 to 6 mm. in thickness. The cut surface of the wall is yellowish-gray, mottled with hemorrhage. The lining mucosa appears to be ragged and brown. The gallbladder is empty and collapsed except for one round gallstone measuring 4 mm. in diameter.

Microscopic: The mucosa of the gallbladder is largely flattened and the folds are not prominent. The epithelium is well preserved. Abundant round cell infiltration prevades the tunica propria and the muscularis. Moderate amounts of hemorrhage are present in some portions. The adventitial coat is very greatly thickened. In some sections, there are some well differentiated islands of pancreatic tissue, complete with small ducts, islands of Langerhans and typical acini. These portions of pancreas show considerable interstitial fibrosis.

Diagnosis: (1) Chronic cholecystitis, with cholelithiasis; (2) aberrant pancreatic tissue.

I wish to thank Major Lester S. King, M.C. Pathologist at the William Beaumont General Hospital, El Paso, Texas, for his pathological report.

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TRAUMA TO THE SESAMOID BONES OF THE THUMB

GEO. BALLANTYNE REITZ, M.D.
Attending Surgeon, St. John's Hospital
BROOKLYN, NEW YORK

INJURY to the sesamoid bone of the hand may produce marked disability and produce a clinical entity, the true nature of which is frequently overlooked. The sesamoid bones of the hand are two very small nodules which lie in the tendons of insertion of the flexor pollicis brevis and abductor pollicis. They are blended with the palmar ligament of the metacarpophalangeal joint and play against the palmar surface of the head of the metacarpal bone. Because of their anatomical position they are subjected to certain trauma, both direct and indirect and cause a very painful condition in the hand. As they lie in the tendon to the thumb and over the head of metacarpal number one, any force applied to that area, either acutely directed or by intermittent occupational irritation, may be the cause of inflammation of these bones, a condition which is not always thought of.

The two cases reported here came to my attention within one month and show injury to these bones, one by direct force and the other as a result of chronic occupational irritation.

CASE REPORTS

CASE I. A. G., a male, thirty-five years of age, gave no history of previous accident to either hand. The patient stated that on June 1, 1945, while drilling a piece of bronze, the drill got stuck in the hole and the piece of material was whirled around and hit the palmar surface of the left hand over the first metacarpophalangeal articulation. There was considerable pain and swelling over the site of injury. Pain continued and was accentuated each time anything was grasped by the hand or if any pressure was made directly over the injured part of the hand. *X*-ray of the bones of the thumb in anteroposterior, lateral and oblique planes was negative for bone or joint disorder. Examination of the hand revealed neither limitation of motion nor any acquired or congenital deformities of the fingers. There were no swellings nor any signs of inflammation. The first metacarpal bone examined by dorsal and palmar routes showed no tenderness nor swelling along the entire length. There was point tenderness on the palmar surface over the distal head of metacarpal number one. This could be elicited by direct pressure which was more acute if the tendon and sesamoid were grasped between the examining index finger and thumb.

This patient was admitted to the hospital and operated upon. Under pentothal sodium anesthesia, with tourniquet applied, an incision was made on the palmar surface of the hand, just below the crease of the metacarpophalangeal articulation of the thumb. The incision was through skin only; all other deeper dissection was done in the plane of the tendons and other important structures. The tendons were retracted; the sesamoid bone was exposed and removed. The deeper structures were reconstructed with No. 000 plain catgut. The skin was brought together with black silk. A pressure dressing was applied and the hand immobilized. The usual two weeks' immobilization followed, and then active and passive motion with hot soaks was started.

The pathological report follows: *Gross:* The specimen consists of irregular piece of tissue 1.7 by 0.5 cm. One portion is grayish white and calcified. The adjacent portion is pinkish gray, pliable and soft. *Microscopic:* One portion of the tissue is composed of trabeculae of cancellous bone. Compact fibrous tissue is attached to the margins. There is moderate hyalinization.

CASE II. L. C. a female, forty-seven years of age, had had no previous injury to her hands. Her work consisted of holding a piece of work in her left hand and putting insulation into this structure. It was necessary to grasp the apparatus tightly in her left hand and exert considerable pressure with the right hand.

* From the Hand Clinic, St. John's Hospital, Brooklyn, N. Y.

After five months at this work she complained of pain in the palm of the left hand over the base of thumb at the metacarpophalangeal articulation.

X-rays taken in the three planes were negative. Examination of the hand showed no arthritic changes, no acquired nor congenital deformities, no swellings nor signs of inflammation and no loss of motion of any of the fingers. The only positive finding was tenderness over the sesamoid bones, elicited by direct pressure and also by lateral pressure, using the examining index finger and thumb.

This case was admitted to the hospital for operation and the same procedure was followed as on the previous case.

The pathological report follows: *Gross:* The specimen consists of a piece of bone 0.4 cm. in diameter which is irregular and covered by a scant amount of reddish gray fibrous and muscular tissue. *Microscopic:* The specimen is composed of coarse trabeculae bone with scattered irregular marrow spaces. Osteocytes are poorly defined. Dense, caliginous fibrous tissue is fused with the margins. There is a focal osteoblastic activity. Fibroblasts of ovoid and fusiform types are scattered through the intersticis.

On January 10, 1946, final follow-up of these cases showed both of them to be symptom free. There was no pain, nor disability and they had returned to their usual work.

AMPUTATION at the wrist should be planned, if possible, so as to save the thumb and a finger or other portion of the hand against which the thumb may be apposed. *Amputation at the wrist* prevents the proper fitting of an artificial hand and wrist mechanism without undue length, and *should be avoided.*

From "Principles and Practice of Surgery" by W. Wayne Babcock (Lea & Febiger).

POST-PARTUM, BILATERAL CORTICAL NECROSIS OF THE KIDNEYS WITH RECOVERY*

J. Rob't. Rinker, M.D.
Diplomate of the American Board of Urology

AND

J. W. Thurmond, M.D.
Diplomate of the American Board of Obstetrics and Gynecology

AUGUSTA, GEORGIA

BILATERAL cortical necrosis of the kidneys is a rather rare disease, 70 per cent of the cases reported being a complication associated with the termination of pregnancy, the remaining 30 per cent followed a variety of infections or toxic conditions. The disease is usually fatal. Madding et al.[1] reviewed the literature in 1940, finding seventy-four cases reported and added one case. Of these seventy-five cases (fifty-three pregnant) only twelve recovered, a mortality of 84 per cent, and only one gave birth to a live fetus (twins).[1] We believe that our case is unusual in that the patient recovered, though she almost succumbed; secondly, because she gave birth to twins, still living, which is singular, since the only other case in which the fetus was alive at birth was a twin pregnancy. Since recovery is rare one feels justified in reporting this case to show the degree of recovery after a year. Fortunately, we do not have autopsy findings to verify the diagnosis, but the clinical course was most characteristic of those cases reported.

The onset of this disease is characterized by a sudden total anuria or severe aliguria with the passing of scanty amounts of bloody urine at the time of delivery or shortly thereafter. The delivery of a stillborn between fifth and eighth month is most frequent.[2] Retroplacental hemorrhage or severe hemorrhage at time of delivery seems characteristic. Shriver found fourteen of thirty-three cases to be complicated by retroplacental hemorrhage,[3] and Stening's case began with a severe accidental hemorrhage and premature delivery.[4] The case reported from the Mayo Clinic occurred after delivery of a dead fetus associated with severe hemorrhage requiring transfusion.[1] No particular symptoms are noted, prior to delivery, although some of the patients had headache, edema and some signs of toxemia. The course is one of continued anuria or aliguria with azotemia, simulating an obstructive anuria, except that there is little or no renal tenderness. Blood pressure is usually not elevated but may increase during the course of the disease. Edema may not be present or may appear gradually and be associated with convulsions of the eclamptic type. Hiccough and uremic convulsions are terminal developments.

Ricker ascribes the changes in the kidney to vascular irritability leading to vasoconstriction of the proximal segments of the renal arteries with dilatation of the terminal arterioles and capillaries which is followed by thrombosis, exudation, hemorrhage, infiltration and necrosis of the renal cortex.[3] While the exact pathogenesis of the process is not known, most writers subscribe to Oertel's concept that the disease is an angioneurotic anuria and "if circulation is reestablished and stasis relieved, corpustular conglutination is dissolved and offers no obstruction to renewed flow"[2] which would make recovery possible.

CASE REPORT

Mrs. S., aged thirty-two, white, the wife of a physician, primipara at seven and one-half months, came to the University Hospital,

* From the Departments of Urology and Obstetrics, University Hospital, Augusta, Ga.

July 29, 1944. She was in labor with the diagnosis of a twin pregnancy. The antepartum course had not been remarkable. The cervix was dilated on admission and soon after a female was delivered by breech extraction by one of us (J. W. T.) followed by a second delivery of a female by low forceps. Both babies were small but appeared to be in good condition. Delivery was followed by hemorrhage and reduction of hemoglobin to 6 Gm. Her blood was type IV, Rh positive. A transfusion of 500 cc. of citrated blood which was compatible on cross match was given. Blood pressure was 110/80 and there was no reaction during the transfusion or any symptoms that would suggest that the blood was incompatible.

She was catheterized two hours later and 300 cc. of dark urine were obtained but not examined. She had not voided by the next morning and was catheterized; 4 cc. of thick dark brown urine were obtained. The second morning 20 cc. were obtained by catheter, dark in color and contained many red blood cells and white blood cells. Urological consultation was requested. At this time her hemoglobin was 7½ gm., red blood cells, 2,450,000, white blood cells 11,850; non-protein-nitrogen 74 mg. per 100 cc. of blood. The usual therapeutic measures were administered; intravenous fluids, aminophylin, alkalies, etc., without apparent benefit. The splancnics were injected with novocaine by the neurosurgeon, Dr. W. A. Risteen, and in the next twelve hours 50 cc. of urine were excreted. The next twelve hours she was not catheterized. On the third day of the anuria her non-protein nitrogen was 90 mg., blood chloride 525 mg., serum protein 4.01 per cent. Cystoscopy and ureteral catheterization were done to rule out local disorder or obstruction and were negative.

The fourth day 25 cc. of urine were obtained. Clinically, her condition was much worse, her blood pressure rising to 148/90 with some edema. On the fifth day the non-protein nitrogen was 64 gm., blood pressure 162/100. Edema had become marked and she appeared to be moribund. Her pulse was 130 and was of poor volume; prior to this date it had not been above 90 and had been of good quality. She began to have eclamptic type of convulsions in rapid succession which were controlled with magnesium sulfate and followed by coma; up to this time she had been in good contact, had no complaint of pain and was still afebrile.

On the sixth day 600 cc. of urine were obtained by catheter; later she voided 200 cc.; blood pressure was 138/80; non-protein nitrogen 72 mg. She still looked very ill. On the seventh day she voided 1,250 cc. of pale urine which contained a moderate number of pus cells; blood pressure was 160/88; pulse 105; 500 cc. of plasma were given. On the eighth day she voided 1,450 cc., blood pressure was 160/90 non-protein nitrogen 81 mg., carbon dioxide 56 per cent. On the ninth day, blood pressure was 142/80 non-protein nitrogen 72 mg., blood chlorides 388 mg. On the tenth day blood pressure was 130/70 non-protein nitrogen 81 mg. On the thirteenth fifteenth and eighteenth days the nonprotein nitrogen was 54 mg., 47 mg. and 36 mg., respectively.

On the twenty-fifth day she was discharged much improved, her blood pressure was 120/80. The urine contained many white blood cells. Mosenthal test: The day urine totalled 1,170 cc., specific gravity ranging from 1.007 to 1.014. The night urine totalled 470 cc., specific gravity, 1.014. P.S.P. (I.V.) 10 per cent first hour; 10 per cent second hour, total 20 per cent in two hours, hemoglobin 9.1 Gm. She was given mandelic acid therapy for Bacillus coli in the urine, probably the result of catheterization and told to return in a month.

She was seen again on September 24, 1944. The urine specific gravity was 1.000 and negative; non-protein nitrogen 19 mg.; white blood count 7,600; hemoglobin 11 Gm. Mosenthal test: Day specimen 1,040 cc.; specific gravity ranging from 1.006 to 1.014; night urine: 450 cc.; specific gravity 1.016, P.S.P. (I.V.) first half hour 15 per cent; second half hour 15 per cent; second hour 5 per cent; total 35 per cent in two hours.

On November 13, 1944, she was feeling well. Her blood pressure was 120/70; urine specific gravity 1.007 and negative; hemoglobin 10 Gm.; non-protein nitrogen 24 mg., P.S.P. (I.V.) 15 per cent first half hour, 25 per cent second half hour, and 10 per cent second hour; total 50 per cent in two hours. I.V. urogram was normal. Mosenthal test: 990 cc. day urine; specific gravity ranged from 1.004 to 1.024; night urine 300 cc.; specific gravity 1.023.

On March 12, 1945, she was in a satisfactory condition. Her blood pressure was 110/70; urine specific gravity was 1.008 and negative; hemoglobin 12.25 Gm.; P.S.P. (I.V.) first half

hour thirty per cent; second half hour 15 per cent; second hour 10 per cent, total 55 per cent in two hours. Mosenthal test: day urine 865 cc.; specific gravity ranging from 1.007 to 1.024; night urine, 160 cc.; specific gravity 1.033. The twin daughters were doing well.

COMMENT

A case is presented in which the clinical history and course is quite typical of bilateral cortical thrombosis, following a premature delivery associated with hemorrhage. The following facts aid in differentiating this case from a transfusion reaction: The blood which the patient received was typed and cross matched by a competent technician, the patient was Rh. positive which would preclude difficulty due to the Rh. factor. There was no evidence of a reaction from the transfusion or jaundice following. The urine contained red blood cells and was a hematuria, not a hemoglobinuria from the onset.

No casts were found and albumin in the urine ranged from three plus to a trace, but it seemed that most of the albumin could be accounted for by blood or pus cells present. While the response from the splancnic block was not dramatic it is difficult to evaluate in this case. In view of Oertel's concept it would seem to be a rational therapeutic procedure as it should relax the proximal renal arteries and aid in reestablishing circulation in the terminal arterioles and capillaries, particularly if done early in the course of the disease. Early reestablishment of circulation should spare some areas of the cortex and diminish the total area of necrosis. Fluids, acid base balance and supportive treatment are essential. From the follow-up study of this case one would conclude that there is a gradual improvement with return of normal kidney function over the period of a year.

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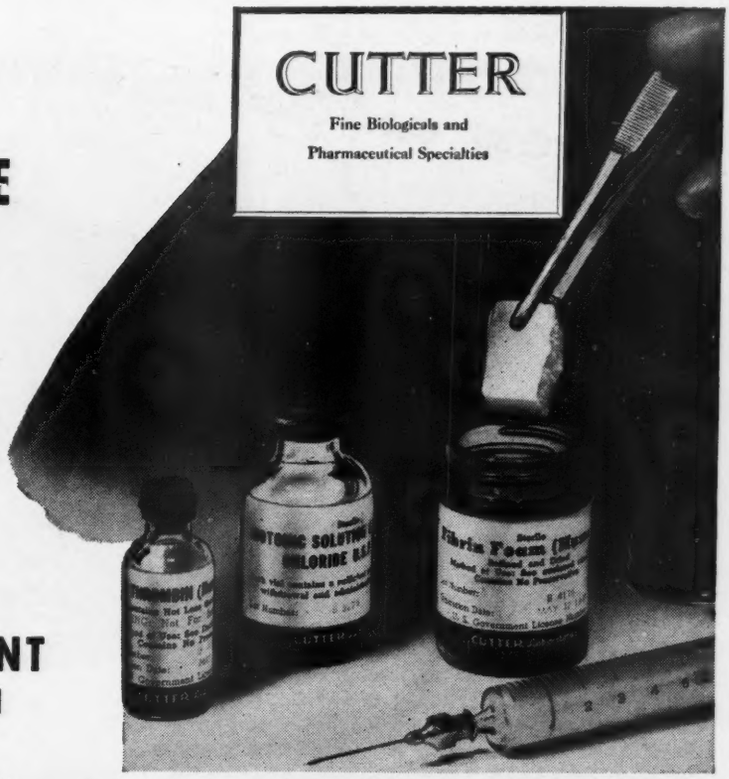

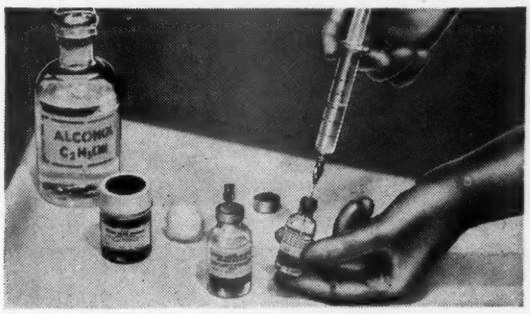

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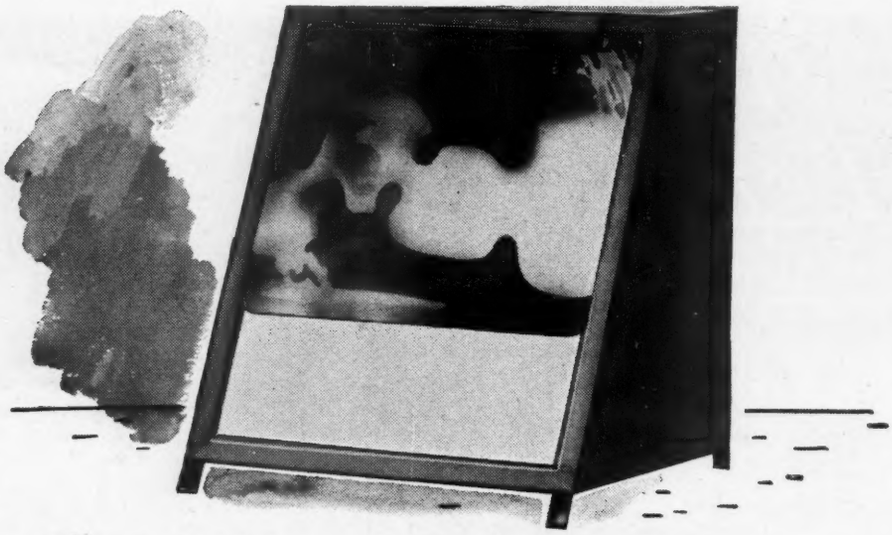

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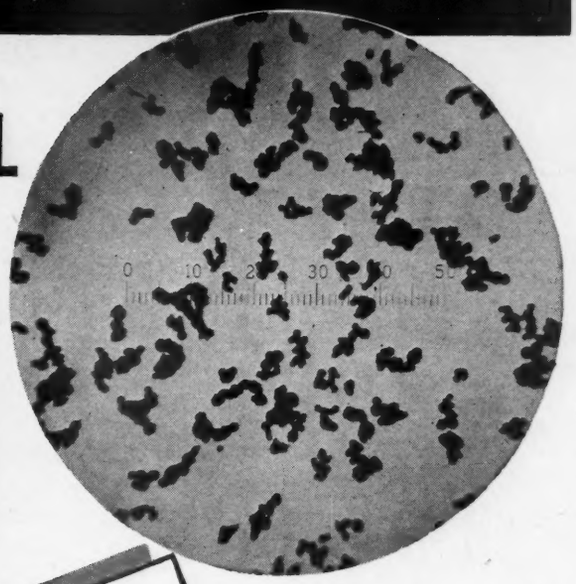

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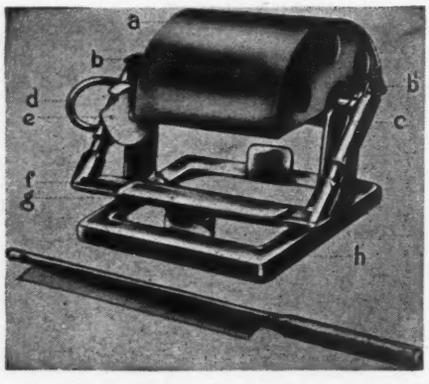

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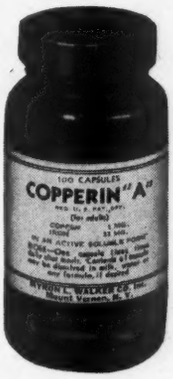

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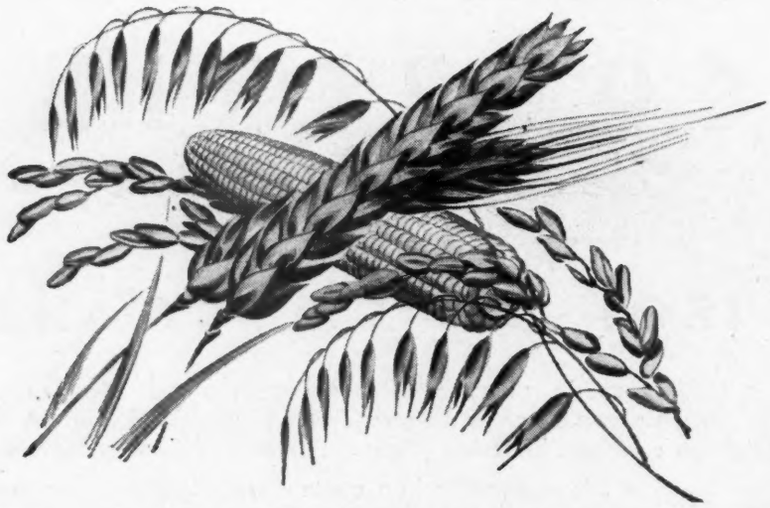

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